FINAL

Willamette Cove Sufficiency Assessment

Willamette Cove Project Area

Prepared for the Willamette Cove In-Water Remedial Design Group

June 29, 2020

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Abbreviations and Acronyms

ACB	articulated concrete block
AOC	Administrative Settlement Agreement and Order on Consent for Remedial Design at Willamette Cove Project Area
AOC-SOW	RD Statement of Work for the Willamette Cove Project Area
BEHI	Bank Erosion Hazard Index
BNSF	BNSF Railway
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
City	City of Portland
COC	contaminant of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CRD	Columbia River Datum
CSM	conceptual site model
CUL	cleanup level
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DDx	The sum of DDD, DDE, and DDT
DEQ	Oregon Department of Environmental Quality
DL	detection limit
DSL	Oregon Department of State Lands
ECSI	Environmental Cleanup Site Information
ENR	Enhanced Natural Recovery
EPA	U.S. Environmental Protection Agency
GSI	GSI Water Solutions, Inc.
HxCDF	1,2,3,4,7,8-hexachlorodibenzofuran
IC	institutional control
JSCS	Joint Source Control Strategy
M&B	McCormick & Baxter Creosoting Company
MNR	monitored natural recovery
MOU	memorandum of understanding
NAPL	non-aqueous phase liquid
ODOT	Oregon Department of Transportation
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PDI	Pre-Design Investigation
PeCDD	1,2,3,7,8-pentachlorodibenzo-p-dioxin
PeCDF	2,3,4,7,8-pentachlorodibenzofuran
Project Area	Willamette Cove Project Area
PTW	principal threat waste

RA	remedial action
RD	remedial design
RAL	remedial action level
RM	river mile
ROD	Record of Decision
SA	Sufficiency Assessment
SCM	source control measure
SMA	sediment management area
SOW	statement of work
SPM	settling particulate matter
SSCOC	site-specific contaminant of concern
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCDF	2,3,7,8-tetrachlorodibenzofuran
TPH	total petroleum hydrocarbon
WC Group	Willamette Cove In-Water Remedial Design In-Water Group
WC Upland Facility	Willamette Cove Upland Facility
UPRR	Union Pacific Railroad
VOC	volatile organic compound

SECTION 1: **Introduction**

This Sufficiency Assessment (SA) was prepared by GSI Water Solutions, Inc. (GSI), on behalf of the City of Portland (City); Port of Portland; and State of Oregon, acting by and through the Department of State Lands (DSL); collectively referred to as the Willamette Cove In-Water Remedial Design In-Water Group (Willamette Cove [WC] Group). The WC Group entered into an Administrative Settlement Agreement and Order on Consent (AOC) for Remedial Design at Willamette Cove Project Area, U.S. Environmental Protection Agency (EPA) Region 10, Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Docket No. 10-2019-0142 (EPA and WC Group, 2019) to conduct remedial design (RD) work within the Willamette Cove Project Area (Project Area) (Figure 1-1). This SA Report was prepared in accordance with the RD Statement of Work for the Willamette Cove Project Area, dated August 2019 (AOC-SOW, which is Appendix A of the AOC) (EPA and WC Group, 2019). The objective of this SA was to evaluate upland and in-water contaminant pathways and determine whether they have been sufficiently investigated, considered, or controlled to allow remedial action (RA) to proceed. If data gaps are identified, or additional source control measures (SCMs) beyond those already in place may be needed to help evaluate pathways or mitigate potentially adverse impacts to the RA, they will be identified through this SA. The SA Report includes these specific objectives:

- Evaluate upland (direct discharges, groundwater, and riverbank erosion) and in-water (upriver settling particulate matter [SPM], Project Area sediment resuspension, groundwater advection [porewater], and existing structures and overwater activities) contaminant pathways to identify potential sources of adverse impacts to the RA and factors that may affect remedy effectiveness.
- Evaluate whether current potential sources and pathways are adequately investigated and controlled such that the RA can proceed.
- Present limitations of the SA and identify data gaps related to the upland and in-water pathways.

The approach and methodology used to meet these objectives are provided in Section 2 of this SA Report. The remainder of this section is intended to detail the Project Area, relevant upland parcels, and historical work that has been done to assess and address upland and in-water pathways of contaminates to the Project Area.

1.1 Project Area and Upland Property Description

For the purposes of this SA, conditions in the Project Area, upland parcels adjacent to the Project Area, and areas contributing to direct discharges (stormwater) were considered. These areas are described in the following sections.

1.1.1 Project Area

The Project Area as defined in the AOC-SOW and is shown in Figure 1-1 (EPA and WC Group, 2019). The Project Area lies between river mile (RM) 6.1 and 6.9 along the northeast bank of the Willamette River and covers approximately 46 acres. This area includes approximately 6 acres of the Willamette Cove Upland Facility (WC Upland Facility) riverbank extending from the top of the bank (break in slope) downward to the -2 ft. Columbia River Datum (CRD) contour line, which defines the riverbank/shallow region (EPA, 2019a). The portions of the Project Area between the -2 ft CRD contour and the federal navigation channel are considered the intermediate region for the purposes of RD (EPA, 2019b). The intermediate region within the Project Area is approximately 41 acres. No portions of the Project Area extend beyond the navigation channel boundary (Figure 1-1).

1.1.2 Adjacent Uplands to the Project Area

Upland parcels immediately adjacent to the Project Area include the WC Upland Facility, which is divided into three parcels: East, Central, and West, covering approximately 24 acres; and the eastern portion of Crawford Street Property referred to as the "Crawford Street Area" in the AOC-SOW (EPA and WC Group, 2019), which covers approximately 4 acres. The area west of the Crawford Street Area is another portion of the Crawford Street upland property that is not considered in this SA. Figure 1-1 shows the location of these upland parcels and adjacent bounding properties. These properties are bounded by the Willamette River to the south and the Union Pacific Railroad (UPRR) line to the north. To the east of the Project Area is the McCormick & Baxter Creosoting Company (M&B) sediment cap and the BNSF Railway (BNSF) railroad bridge that delineate the upstream end of the Project Area.

1.1.2.1 Willamette Cove Upland Facility

The WC Upland Facility is currently vacant. Since 1997, the WC Upland Facility has been listed in the Environmental Cleanup Site Information (ECSI) database (Site ID 2066) due to the presence of contaminants of concern (COCs) in soils and groundwater. Currently, remediation and management of the WC Upland Facility is being performed under Voluntary Cleanup Agreement ECVC-NWR-0026 between the Port, Metro, and the Oregon Department of Environmental Quality (DEQ) (DEQ, 2000).

1.1.2.2 Crawford Street Area

The Crawford Street Area is currently owned by Columbia Forge & Machine Works and is currently zoned for industrial use (DEQ Environmental Cleanup Site Information [ESCI]). Like the larger WC Upland Facility, the Crawford Street Area also includes portions of the riverbank above the ordinary low water line, but these areas are not considered part of the Project Area as defined in the AOC-SOW (EPA and WC Group, 2019). Since 1999, CSC site of which the Crawford Street Area is a part has been listed in the ECSI database (Site ID 2363) managed by DEQ due to COCs in soils and groundwater. In the future, additional information may be collected within the Crawford Street Area in support of an ongoing source control evaluation.

1.1.2.3 BNSF Railroad Bridge

The BNSF railroad bridge is located along the eastern edge of the Project Area. Limited information is available about the bridge construction, history, and chemical impacts. Given its location between the M&B site and the Project Area—and the common impacts associated with railways and their associated structures—there is the potential that active pathways that may adversely impact the RA are present (DEQ, 2016). Active pathways associated with the BNSF railroad bridge may include the M&B site groundwater plume, bridge materials containing contaminants, and contaminants associated with railway operations such as polychlorinated biphenyls (PCBs) (PTI Environmental Services [PTI], 1995; DEQ, 2016). Given the limited information available about the BNSF railroad bridge, it is not possible to make assessments of its associated pathways.

1.1.2.4 McCormick & Baxter Creosoting Company

The former M&B site is located immediately east of the BNSF railroad. The U.S. Department of Environmental Protection (EPA) added the M&B site to the National Priorities List in June 1994 and issued a record of decision (ROD) for the M&B site in 1996. This site is important to this SA because a contaminated groundwater plume originating from the M&B site was determined to be seeping into the sediments of Willamette Cove immediately adjacent to the Project Area (EPA, 1996). The M&B site sediment RA encompasses 23 acres of riverbed including a sediment cap located along the southeast edge of the Project Area. For the purposes of this SA, it is important to note that the cleanup goals established in the M&B site ROD differ from those established for the Portland Harbor Superfund Sie. Because of this, the M&B site remedy may be functioning in accordance with its design objectives while continuing to pose a risk to the RA proposed for the Project Area. Further discussion of the M&B site is presented in Section 4.3.2.1.

1.1.3 Portland Harbor Superfund Site Record of Decision Requirements for the Project Area

The Project Area remedy identified in the Portland Harbor Superfund Site (Site) ROD designated specific areas for active remediation (capping and dredging) based on exceedances of Portland Harbor Superfund Site-wide remedial action levels (RALs) and principal threat waste (PTW) highly toxic thresholds of the following focused COCs: PCBs, polycyclic aromatic hydrocarbons (PAHs), and several dioxin congeners (EPA and WC Group, 2019). The RALs and applicable PTW thresholds identified in Table 1-1 are higher than CULs and are defined by EPA as “contaminant-specific sediment concentrations of focused COCs used to identify areas where capping and/or dredging will be conducted in order to reduce risks more effectively than ENR (enhanced natural recovery) or monitored natural recovery (MNR)” (EPA, 2017). The areas designated in the ROD for active remediation are called sediment management areas (SMAs). Once the active remediation is complete, the remaining sediments with concentrations less than RALs and PTW but greater than CULs will be remediated via MNR. The MNR process is influenced by many factors, but its ability to achieve CULs is assumed in the ROD and will be confirmed through long-term monitoring across the entirety of the Portland Harbor Superfund Site after RAs are implemented.

The ROD also identified nine remedial action objectives (RAOs) for the Site. The RAOs are media-specific goals linked to the CULs for various media to be protective of humans and ecological receptors. Multiple pathways and potential sources outside of the Project Area are considered in this SA in the context of the ability to achieve RAOs.

1.2 Integration of In-River CERCLA Remedy and Upland Source Control Program

EPA and DEQ developed a source control strategy to identify, prioritize, and control potential sources of contamination to the river (Portland Harbor Joint Source Control Strategy [JSCS], DEQ and EPA, 2005). Under the JSCS, EPA is the lead agency for the Portland Harbor Superfund Site in-water cleanup, and DEQ is the lead agency for upland cleanup pursuant to a 2001 memorandum of understanding (MOU) among EPA, DEQ, state, and federal natural resource agencies and six tribal nations. Pursuant to the MOU, DEQ is responsible for identifying and controlling upland sources of pollution to the river that may recontaminate and adversely impact sediment remedies post construction.

In the Project Area, DEQ has overseen a significant amount of work in the WC Upland Facility and Crawford Street Site properties to assess their potential as a source of recontamination to sediments in the Project Area. This SA will refer to DEQ's JSCS work and conclusions and rely on the assumption that DEQ will remain the lead agency for identifying and controlling upland sources of pollution.

1.3 Upland Source Control Status and DEQ Conclusions

The most recent Portland Harbor Upland Source Control Summary Report (DEQ, 2016) is organized by areas called “georegions.” This report describes source control actions completed to date and determines the recontamination potential at individual sites within these georegions. The WC Upland Facility and the Crawford Street Area adjacent to the Project Area are within the St. Johns georegion. In Section 4.6.5 of the 2016 Source Control Summary Report, DEQ has concluded that “sediment recontamination potential and risk to aquatic receptors for the St Johns geographic region is low and source control has sufficiently been achieved to support the in-water remediation work.” However, the report identified that in the WC Upland

Facility, remediation of beach and riverbank areas should be incorporated into the RA, and groundwater source controls should be implemented.

SECTION 2: **Sufficiency Assessment Approach**

The objective of the SA is to evaluate potential upland and in-water pathways of contamination and make determinations about whether they have been adequately investigated and controlled to allow the in-water RA to proceed. This SA was developed in compliance with the requirements presented in the AOC-SOW (EPA and WC Group, 2019) using readily available information on conditions in the Project Area and adjacent upland parcels. For the purposes of this SA, recontamination of the remediated sediment surface occurs if concentrations of COCs exceed RALs or PTW on the remediated surface.

The components of this SA include the following:

- **Identification of Site-Specific Contaminants of Concern (SSCOCs, Section 3):** This section screens the existing surface sediment data in the Project Area against RALs and PTW thresholds and evaluates the frequency of CUL and background concentration exceedances to identify SSCOCs for the purposes of the SA.
- **Upland and In-Water Contaminant Pathway Conceptual Site Model (CSM) (Section 4):** This section presents the CSM, detailing the setting of the Project Area, the adjacent upland parcels, and the upland and in-water pathways assessed as part of this SA.
- **Pathway Evaluations (Section 5):** This section evaluates each upland and in-water pathway that depends on the characteristics of that pathway, available data, and potential for the pathway to adversely impact the RA.
- **Future Conditions (Section 6):** This section discusses potential future conditions and determines if they have the potential to adversely impact the RA or if special RD considerations are warranted.
- **Conclusions and Recommendations and Next Steps for Remedial Design (Sections 7 and 8):** These sections provide conclusions about potential pathways that may adversely impact the RA and provide recommendations to close any remaining data gaps, increase confidence in future SA tasks, and propose any additional SCMs that may be needed to ensure the RA remains protective into the future.

These sections address the SA requirements set forth in the AOC-SOW (EPA and WC Group, 2019). Table 2-1 details the specific requirements established in the AOC-SOW and the corresponding report sections, tables, and figures that address them. Following construction of the RA, the sufficiency of SCMs and effectiveness of the RA will be assessed through a long-term monitoring program.

SECTION 3: **Identification of Project Area-Specific Contaminants of Concern**

The SSCOC identification process requires screening available surface sediment data from within the Project Area against the Portland Harbor Superfund Site RALs, PTW thresholds, and CULs for COCs in sediment. The technical basis for this approach is based on the assumption that surface sediment (upper 30 cm) within Willamette Cove represents an integration of potential recontamination sources at the time the samples were collected and analyzed. The SSCOCs identified through this process are used in the upland and in-water pathway evaluations (Sections 5.1 and 5.2) to assess the potential for recontamination from these pathways.

3.1 Contaminants of Concern Point-by-Point Screening Process

Data used in this screening were previously presented in the Portland Harbor Feasibility Study (EPA, 2016a) and the PDI Evaluation Report Portland Harbor Pre-Remedial Design Investigation (AECOM and Geosyntec, 2019). The COC screening process was completed on a point-by-point basis. No statistical groupings (surface-weighted area concentrations) were performed; therefore, this approach is considered conservative for the purposes of identifying SSCOCs. Existing surface sediment data were screened in two primary steps as described in the following sections.

3.1.1 Table 21 RAL and PTW Screening

The first step in the COC screening process was to compare the RALs and PTW thresholds established in Table 21 of the Portland Harbor Superfund Site ROD with available surface sediment data. When a chemical with an associated RAL (referred to as "Focused COCs") or an additional contaminant in ROD Table 21 exceeded a RAL or PTW threshold, it was carried forward as an SSCOC. The surface sediment sample locations used in this screening are shown in Figure 3-1. The Step 1 screening process and results are presented in Table 3-1. From this screening step, all six focused COCs (those with RALs) are carried forward as SSCOCs. Additionally, two dioxin/furan congeners (1,2,3,4,7,8-hexachlorodibenzofuran [HxCDF] and 2,3,7,8-tetrachlorodibenzofuran [TCDF]) were retained because of exceedances of PTW thresholds (due to being not reliably contained or high toxicity).

Chlorobenzene and naphthalene are identified as "additional contaminants" in Table 21 of the Portland Harbor Superfund Site ROD and have associated values for PTW (not reliably contained or high toxicity). These two compounds did not have detections above the PTW threshold and, therefore, were screened out as SSCOCs.

3.1.2 Table 17 CUL Screening

The second step in the COC screening process was to compare surface sediment data collected within the Project Area to Table 17 of the Portland Harbor Superfund Site ROD which lists sediment CULs. A COC was carried forward as a SSCOC when the corresponding CUL was exceeded in more than 10 percent of the samples or when a COC had a concentration that exceeded the CUL by greater than three times the CUL. Note that pentachlorophenol (PCP) is not included in this screening because it is not a COC for sediment in either Table 17 or Table 21 of the Portland Harbor Superfund Site ROD. The Step 2 screening process and results are presented in Table 3-2.

While arsenic was retained as an SSCOC through this Table 17 CUL screening step, it is important to recognize that arsenic is naturally elevated in soil in the Portland Basin and throughout the Portland Harbor Superfund Site, and the concentrations found in the WC Project Area are characteristic of background in this area. For example, the screening showed that, of the 60 sediment samples, 43 exceeded the EPA CUL of 3 milligrams per kilogram (mg/kg), yet, of these exceedances, only one sample exceed the DEQ background level of 8 mg/kg (DEQ, 2013). This narrow and uniform distribution does not suggest an upland source and further supports that the concentrations are a result of background-level occurrences of arsenic. Additionally, there are no known upland sources of arsenic in the uplands adjacent to the Project Area, which is a further line of evidence that the arsenic CUL exceedances are due to natural background and not anthropogenic sources. This uncertainty will be considered during RD.

3.1.3 Identification of Project Area-Specific Contaminants of Concern

The SSCOCs identified through the screening process and their associated CULs, RALs, and PTW thresholds are presented in Table 3-3. Based on the screening steps, the following 14 COCs have been identified as Project Area SSCOCs through the screening process detailed in Sections 3.1.1 and 3.1.2.

- Mercury (CUL exceedances in greater than 10 percent of samples)
- Arsenic (CUL exceedances in greater than 10 percent of samples) (Note – refer to Section 3.1.2 for a discussion of arsenic and the associated uncertainty related to naturally occurring background concentrations.)
- Dioxin/furans
  - 1,2,3,4,7,8-hexachlorodibenzofuran (HxCDF) (PTW threshold exceedances)
  - 1,2,3,7,8-pentachlorodibenzo-p-dioxin (PeCDD) (RAL and PTW threshold exceedances)
  - 2,3,4,7,8-pentachlorodibenzofuran (PeCDF) (PTW threshold exceedances)
  - 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (RAL exceedances)
  - 2,3,7,8-tetrachlorodibenzofuran (TCDF) (PTW threshold exceedances)
- Petroleum hydrocarbons
  - Total carcinogenic polycyclic aromatic hydrocarbons (cPAHs) (CUL exceedances in greater than 10 percent of the samples)
  - Total PAHs (RAL exceedances)
  - Total petroleum hydrocarbon (TPH) Diesel (CUL exceedances in greater than 10 percent of the samples)
- Total PCBs (RAL and PTW threshold exceedances)
- Pesticides
  - Dieldrin (CUL exceedances in greater than 10 percent of the samples)
  - Total DDx (CUL exceedances in greater than 10 percent of the samples)
  - Total chlordane (CUL exceedances in greater than 10 percent of the samples)

The SSCOCs identified through this process are consistent with those identified in the AOC except for the pesticides dieldrin, total DDx, and chlordane, which are included here since they had CUL exceedances in greater than 10 percent of samples with detections (EPA and WC Group, 2019). These SSCOCs cover a broader range of chemicals than the focused COCs (PCBs and PeCDD) identified for the Willamette Cove Sediment Decision Unit in the Portland Harbor Superfund Site ROD (EPA, 2017). General descriptions of the nature and extent of the SSCOCs in sediment within the Project Area are provided in Section 4. The potential for the individual SSCOCs to adversely affect the selected remedy is discussed in the upland and in-water pathway evaluations in Sections 5.1 and 5.2.

SECTION 4: **Upland and In-Water Pathway Conceptual Site Model**

This CSM details the physical and chemical conditions within the Project Area and adjacent upland parcels. The objective of the CSM is to provide the technical framework and context for evaluating the potential for adverse impacts to the RA from upland and in-water contaminant pathways. Adverse impacts include recontamination of a remediated sediment surface and the contribution of SSCOCs to the Project Area from multiple pathways at concentrations that would prevent RAOs from being met. To support this objective, upland and in-water pathways with a potential to transport SSCOCs to the in-water project area are identified and described. Evaluations of the potential for these individual pathways to adversely impact the RA are presented in Section 5.

4.1 Identification of Potential SSCOC Sources and Migration Pathways

Figure 4-1 presents an overview of the pathways and mechanisms that were evaluated for this SA. The upland and in-water pathways identified in this figure include the following:

- Upland pathways
  - Direct discharges (stormwater)
  - Groundwater
  - Riverbank erosion
- In-water pathways
  - Upriver SPM
  - Project Area sediment resuspension
  - Groundwater advection (porewater)
  - Existing structures and overwater activities

Section 5 includes detailed descriptions of the physical characteristics and transport mechanisms, SSCOCs and media-specific COCs, and potential adverse impacts to the RA associated with each pathway.

4.2 Project Area-Specific Contaminants of Concern

The SSCOCs for this SA are identified in Table 3-3 based on surface sediment exceedances of RALs or PTW thresholds and/or the frequency of CUL exceedances of individual COCs. Figure 4-2 is a map showing the combined footprint of surface sediment RAL and PTW threshold exceedances for these contaminants using methods consistent with the processes used in the Portland Harbor Feasibility Study (EPA, 2016a). Additionally, Figures 4-3 through 4-16 present the surface sediment RAL, PTW threshold, and CUL exceedances for the 14 individual SSCOCs.

4.3 Description of Upland Parcels and Current Land Use

The following sections detail the upland parcels and current land use near the Project Area.

4.3.1 Upland Parcels and Land Use Adjacent to the Project Area

The upland parcels immediately adjacent to the Project Area (shown in Figure 1-1) encompass approximately 27 acres of the land. The adjacent upland area consists of approximately 3,500 feet of shoreline along the Willamette River, including Willamette Cove itself. As illustrated in Figure 1-1, the upland areas adjacent to the Project Area (exclusive of the City of Portland Outfall OF-49 drainage basin) can be organized into four primary parcels based on location and historical use and ownership.

- The WC Upland Facility is currently vacant. Although a gravel roadway is present, vehicle access is restricted. All buildings associated with past industrial activities in the WC Upland Facility were removed by the early 1990s. Currently, only remnants of past structures remain. The WC Upland Facility parcels are not currently managed for human use, and postings are in place to discourage trespassing, fishing, and recreational use. Despite the postings people are known to access the WC Upland Facility. Historical activities within the WC Upland Facility parcels include:
  - **East Parcel** – The East Parcel was used as a cooperage plan from 1915 until the 1950s. Wood-based industrial activities on the East Parcel continued until 1980.
  - **Central Parcel** – This parcel was originally developed in 1903 in conjunction with the development of two dry docks. The Central Parcel housed numerous support structures for the dry docks until 1950, when the parcel was sold and incorporated into the plywood mill and wood product facility operating on the West Parcel. Fill materials used in the Central Parcel that contain miscellaneous construction debris have been associated with the highest concentrations of dioxin/furan congeners found in upland soils (Apex, 2019).
  - **West Parcel** – This parcel was formerly used as a plywood mill and wood product facility from 1901 until the late 1970s. A log pond on the West Parcel was filled in the early 1970s. This fill was sourced from within Portland Harbor and could be a source of SSCOCs and off-site COCs (Integral Consulting, Inc., 2008).
- **Crawford Street Area**
  - The greater Crawford Street area has been used for a variety of industrial purposes since the early 1900s, including a logging equipment yard, forge and machining shop, woolen mill, plywood mill, and steel yard (Evren Northwest, 2016). Currently, the area south of the UPRR easement where the Crawford Street Area is located is vacant and used solely for storage (Cascadia Associates, 2020). The area is covered in pack gravel and currently has pallets stacked within it. There are no known structures within the Crawford Street Area.

The riverbank portions of the WC Upland Facility, from the top of the bank (defined by the break in slope) to -2 ft CRD, are part of the Project Area (see Figure 1-1) and will be incorporated into the RA. The riverbank portions of the Crawford Street Area are not included in the Project Area but are considered in the pathway assessment performed in this SA. The riverbanks within and adjacent to the Project Area are covered with invasive and native vegetation, which supports opportunistic use by wildlife. Riprap, concrete, and anthropogenic debris are present along much of the riverbank within and adjacent to the Project Area.

4.3.2 Surrounding Properties and Land Use

The following sections detail the properties and land use surrounding the Project Area.

4.3.2.1 McCormick & Baxter Creosoting Company

On the east side of the BNSF railroad embankment (opposite the WC Upland Facility) is the former M&B site, a federal Superfund site. The M&B site is adjacent to the Willamette River and includes 41 acres of upland property and 23 acres of capped riverbed. The M&B site was operated as a wood-treating facility from 1944 to 1991. Multiple wood-treating chemicals were used on the site, including creosote, PCP, water-based chrome, and copper arsenate. In addition to wood-treating chemicals, PAHs and dioxin/furans have been identified as COCs at the M&B site. Operations ceased at this facility in October 1991 (PTI, 1995). On June 1, 1994, EPA added the M&B site to the National Priorities List. In 1996, EPA and DEQ issued a ROD for M&B that included the following actions:

- Capping, excavation, biological treatment, and stabilization of the highly contaminated soils
- A groundwater and non-aqueous phase liquid (NAPL) extraction and treatment system

- Installation of a vertical subsurface barrier wall to contain mobile NAPL
- Sediment capping
- Long-term monitoring
- Institutional controls (ICs)

A portion of the M&B contaminant plume migrated under the railroad embankment and emerged in the sediments adjacent to the Project Area (PTI, 1995). Chemical migration from M&B resulted in the presence of NAPL and a petroleum hydrocarbon sheen along the inner Willamette Cove riverbank. To address these impacts and others, the M&B ROD was issued in 1996 (EPA, 1996). In the ROD, cleanup goals were established for groundwater, soils, and sediments at the M&B site. These goals have been used to implement and assess the effectiveness of upland and in-water RAs. The in-water RA was completed in 2005. This RA included portions of Willamette Cove immediately adjacent to the Project Area. The M&B in-water RA consisted of a sand cap with articulated concrete block (ACB) armoring over 23 acres of contaminated sediment. In areas with creosote seeps, the sand and ACB cap was supplemented with organophilic clay and reactive core mats. Since implementation, the M&B site RA has been determined to be functioning as intended (EPA, 2016b). However, the cleanup goals used at the M&B site differ from the CULs, RALs, and PTW thresholds applied for the Portland Harbor Superfund Site. In some cases, cleanup goals at M&B had significantly higher concentrations than those for the same analyte in the Portland Harbor Superfund Site. For this reason, adverse impacts to the Project Area associated with the M&B site and cap are possible and the previous RA is not in alignment with the objectives established for the Portland Harbor Superfund Site. The M&B cap is not part of the Project Area.

4.3.2.2 BNSF Railroad Right of Way and Bridge

Adjacent to the southeast perimeter of the WC Upland Facility is the BNSF right of way, which is an approximately 50-foot-high embankment with a railroad line on top leading to a railroad bridge over the Willamette River. The bridge and the embankment were constructed between 1906 and 1908. Portions of the southeast perimeter of the Project Area are defined by the BNSF railroad bridge. This bridge is constructed of metal and has been preserved using paints and coatings over time. The railroad remains active and is presently owned by BNSF.

4.3.2.3 Crawford Street Property

The Crawford Street Property, which also includes the Crawford Street Area, has a long history of industrial operations. From the early 1900s, the southern portions of the Crawford Street Property adjacent to the Willamette River have been used for industrial activities by numerous operators. Environmental investigations performed to date were intended to evaluate the nature and extent of contamination and determine if there is a need for RA. One finding of these studies was that concentrations of hydrocarbons and metals were elevated along the riverbank and beach below due to on-site disposal of sand blast grit (black sand). To address the presence of black sand, a removal action (excavation) was performed in the early 2000s that removed approximately 381 tons of material from the property (Evren Northwest, 2015).

The over-steepened riverbank on the Crawford Street Property is vegetated with blackberries, brush, and trees, and much of the bank is armored with broken concrete slabs, and debris from former building foundations. Some broken asphalt was also noted in past studies related to the riverbank (Cascadia Associates, 2020). Along the toe of the riverbank, the beach area is littered with woody debris, pieces of concrete, cobbles, and boulders. Multiple studies assessing the need for SCMs throughout the Crawford Street Property have been conducted since the early 2000s. Most recently and relevant to this SA, a Leave Surface Characterization Evaluation was conducted to characterize the extent of chemicals in riverbank soils that exceed RALs, PTW thresholds, and CULs (Cascadia Associates, 2020). A Bank Erosion Hazard Index

(BEHI) erodibility evaluation was also performed to determine if contaminated soil could reach the river through the erosion pathway (Inter-Fluve, 2017). The findings of this BEHI evaluation are discussed in Section 5.1.3.2.

4.4 Upland Conditions

Upland conditions, including geology, topography, direct discharges (stormwater), and groundwater, are discussed in the following sections.

4.4.1 Geology

The Project Area is in the Portland Basin geologic region. The Portland Basin is situated between the Cascade Mountains to the east and the Tualatin Mountains to the west. The Project Area is located at the lower extent of the Willamette Valley near the confluence of the Willamette and Columbia Rivers. The upper geologic units consist of artificial or dredged fill materials and recent alluvial deposits consisting of silts, sands, and gravels. At times, it can be difficult to distinguish fill from native alluvium because of the similarities between the materials. This is particularly true of areas along the Willamette River where alluvial deposits were often dredged and placed as fill in the uplands. Based on existing reports, the fill and alluvium may be as much as 100 ft thick beneath ground surface (Hart Crowser, 2000). However, a deep stratigraphic boring within the Project Area or adjacent upland properties is not available to confirm this estimate. Based on well logs in the vicinity, the Troutdale Formation is considered bedrock and anticipated to lie immediately below the upper alluvium and fill. The Troutdale Formation consists of cemented sand and gravel. In the absence of the Troutdale Formation, the Columbia River Basalt Group would be considered the bedrock layer.

4.4.2 Topography

The WC Upland Facility is situated on a relatively flat terrace created by historical anthropogenic filling events that helped develop the parcels and natural alluvial processes. The elevation in the Central and East Parcels of the WC Upland Facility ranges between 25 and 40 ft CRD. The West Parcel is graded and slightly higher, at elevations ranging between 45 and 50 ft CRD. In the West and Central Parcels, the riverbank is generally a steep slope down to the river. Sandy beaches are present in some parts of the Central Parcel but most predominantly in the inner portion of Willamette Cove within the East Parcel. The Crawford Street Area is relatively flat and similar in elevation to the West Parcel of the WC Upland Facility.

The eastern boundary of the WC Upland Facility is defined by the BNSF railroad embankment which rises steeply about 50 feet above the low-lying terrace. The UPRR easement marks the northern edge of the WC Upland Facility and the Crawford Street Area. Immediately north of the UPRR easement is a 120- to 150-ft-high vegetated bluff that runs along the East and Central Parcels of the WC Upland Facility but tapers off along the West Parcel as it approaches Richmond Avenue. This geologic feature separates the Central and East Parcels from the residential areas of North Portland.

4.4.3 Direct Discharges (Stormwater)

Direct discharges of runoff can occur during precipitation events on impervious surfaces, or when precipitation that falls onto pervious surfaces exceeds soil infiltration capacity. In the WC Upland Facility, much of the land comprises permeable sandy soils, and consequently, rainfall generally infiltrates without surface runoff or sheet flow (Apex, 2019). Because of this, there are no defined stormwater ditches, catch basins, or outfalls draining the main portion of the WC Upland Facility, and no rills have been identified.

One active outfall, OF-49, discharges to the Project Area. The OF-49 conveyance system drains stormwater from impervious surfaces within the residential and commercial areas north of the bluff. Figure 4-17 shows the drainage area contributing stormwater to OF-49 and land use zoning within the drainage area. No DEQ ECSI parcels were found within the OF-49 drainage basin, but the upland parcels adjacent to the Project Area are all listed in the ECSI database. Also, all Oregon Department of Transportation (ODOT) facilities within the Portland Harbor Superfund Site drainage basin are listed as ECSI No. 5437. Portions of the OF-49 drainage basin are ODOT-maintained roads and highways. An assessment of stormwater quality and potential impacts to the in-water area from stormwater discharge is discussed in Section 5.1.1.

Surface runoff is known to occur in the southeast corner of the Crawford Street Area during periods of heavy rain. Runoff flows are currently directed toward Richmond Avenue, but it is unknown whether the stormwater infiltrates or continues to the West Parcel of the WC Upland Facility or Project Area (Bridgewater Group, 2015).

4.4.4 Groundwater

A significant amount is known about the groundwater beneath the upland parcels adjacent to the Project Area since multiple upland investigations have been conducted within both the WC Upland Facility, Crawford Street Area, and M&B site. The uppermost groundwater zone lies in the unconsolidated fill and recent alluvial deposits. The depth to groundwater varies depending upon the surface elevation but is generally 20 to 40 ft. below ground surface. The depth to water fluctuates due to seasonal recharge and changing river levels because the river is hydraulically connected to the shallow groundwater zone. Water level measurements reported in the Groundwater Source Control Evaluation Report confirm that groundwater passing beneath the WC Upland Facility flows to the Willamette River in the Project Area (Apex, 2020). While there is no empirical data to confirm this, it is likely that temporary localized flow reversals in shallow groundwater occur near the riverbank when river surface water elevations exceed those of the adjacent groundwater table. The direction of flow toward the river and the occurrence of temporary flow direction reversals are consistent with the conditions found at the neighboring M&B site (Hart Crowser and GSI, 2019). There has been no investigation of groundwater units below the uppermost shallow water bearing zone.

4.5 In-Water Conditions

In-water conditions—including hydrology and hydrodynamics, bathymetry and sediment characteristics, and historical structures—are discussed in the following sections.

4.5.1 Hydrology and Hydrodynamics

Hydrologic and hydrodynamic conditions in the Willamette River may adversely impact the RA by resuspending, transporting, and depositing particulate matter containing SSCOCs within the Project Area (EPA, 2016a). The lower Willamette River watershed is shown in Figure 4-18. This reach of river is controlled by a variety of natural and anthropogenic factors, including contributing flows from the Willamette River Basin; tidal fluctuations due to connection with the Pacific Ocean through the Columbia River; operation of dams on the Willamette River, Columbia River, and major tributaries; and channel modifications.

On a seasonal basis, the lowest stage in the lower Willamette River is typically between August and early November, after snowmelt runoff in late spring and summer has passed and before the beginning of seasonal rains in the fall. River stage and discharge rates in the Willamette River generally increase in response to short-term precipitation events throughout late fall and winter (November to March). River stage also typically rises from late May through June when regional snowmelt increases the stage of the Columbia River and Willamette River, creating a hydraulic restriction at their confluence. Regardless of the flow intensity and direction, current speeds are highest in the deeper portions of the river channel, and lower speeds occur in the shallow nearshore areas (EPA, 2016a).

In addition to seasonal fluctuations, ocean tides affect river stage and flow velocities in the Columbia River and lower Willamette River, with effects extending well upriver of the Project Area to Willamette Falls in Oregon City, Oregon, at RM 26. Tidal oscillations can influence Willamette River levels by up to 5 feet in Portland Harbor when the river is at a low stage. These tidal fluctuations may also result in short-term flow reversals (i.e., upriver flow) in Portland Harbor during times of low river stage, particularly in late summer to early fall.

4.5.2 Bathymetry and Sediment Characteristics

Throughout Portland Harbor and the downtown reach of the Willamette River, the channel has been modified and deepened during the last century to make it suitable for navigation and commercial shipping operations. Prior to 1951, maintenance dredging occurred within the Project Area to allow navigation access to the dry docks for ship repair operations that formerly occurred within the cove portion of the Project Area. There are no records of dredging in this area following removal of the dry docks in 1951. Portions of the riverbank along the reach, including the Project Area, have been filled and stabilized, creating hydrodynamic conditions that significantly influence the depositional patterns and material characteristics within this area and along the banks of the Project Area. Construction of the BNSF railroad bridge in the early 1900s and the more recent placement of the M&B cap protect the cove from higher energy flows within the main channel. As a result, the cove portions of the Project Area exhibit relatively quiescent and depositional conditions. Consistent with a low-energy depositional environment, the substrate is predominantly clayey silt/organic silts in the inner Cove area and grades to sandy silt and silty sand toward the navigation channel and downriver portions of the Project Area. The portions of the Project Area downstream of the cove are primarily neutral to slightly erosional due to exposure to high-velocity flows.

The Pre-Remedial Design Group Pre-Design Investigation (PDI) Evaluation Report includes a bathymetric analysis that measured changes in the sediment bed elevation between the 2004 survey conducted by the Lower Willamette Group and the 2018 survey conducted by the Pre-Remedial Design Group. This analysis confirmed the cove is predominantly depositional except for highly localized areas of scouring along the shoreline extending northwest from the M&B cap area (AECOM and Geosyntec, 2019). These depositional patterns are illustrated in Figure 4-19. Bathymetric analysis indicates that significant deposition of more than 10 ft occurred between the 2004 and 2018 surveys conducted on portions of the M&B cap, and up to 5 ft of shoaling at the cove entrance just west of the terminus of the in-water portion of the M&B cap (AECOM and Geosyntec, 2019). Portions of the inner Cove are shown to have received up to 2.5 feet of net deposition between the 2004 and 2018 surveys. While these changes represent only a “snapshot” between two time periods, the results are consistent and support the overall CSM assessment that the cove portions of the Project Area are depositional. Furthermore, because of the shoreline configuration, the cove is protected from high-velocity flows, and therefore, significant scour due to natural flows is unlikely to occur. Due to the high rates of deposition occurring in the cove, there is a possibility that surficial sediments in this area are recovering naturally due to mixing with and isolation through the settling of particulate matter if it is sufficiently clean.

4.5.3 Historical Structures

Numerous structures were developed as part of historical operations within the Project Area and at adjacent upland parcels. For the purposes of this SA, only in-water structures that are within or immediately adjacent to the Project Area are identified. The following are the known structures within the Project Area:

- The M&B cap, which is constructed of ACB, clean sand cover, and organoclay matting, forms a large underwater structure to the east/southeast of the Project Area.
- The BNSF railroad bridge forms the southeastern border of the Project Area. This bridge is constructed of metal and may be a source of SSCOCs related to coating and operations.
- Numerous vessels have sunk within the cove. One vessel was removed as part of the M&B RA. The largest remaining vessel is located along the northern shoreline of the WC Upland Facility. Bathymetry collected in 2020 has also revealed what appear to be multiple other hulls from small vessels near the M&B cap.
- Several rows of remnant piles are found at the toe of the riverbank along portions of the Central and West Parcels of the WC Upland Facility. Whether wood materials associated with these structures were treated is unknown.
- Riprap and anthropogenic debris (concrete, rebar, etc.) are located along the riverbanks throughout the Project Area, either due to on-site disposal, bank stabilization, or both.

4.6 Upland and In-Water Pathway CSM Summary

The Project Area and adjacent upland parcels presently are not managed for human activities but were heavily used for both overwater and upland industrial activities during the last century. These historical activities have included a variety of wood product manufacturing processes, metal fabrication and laydown yards, dry dock and ship repair facilities, and support structures. As a result of these activities and the placement of fill for site development, soil and groundwater contamination exists in the adjacent upland parcels, and impacts to the Project Area are possible (Apex, 2020).

Legacy soil and groundwater contamination in the upland parcels, if uncontrolled, has the potential to mobilize and adversely impact an in-water RA within the Project Area. Additionally, pathways including direct discharges and in-water inputs from areas outside of the Project Area, if uncontrolled, have a potential to contribute SSCOCs to the Project Area. If these pathways are determined to be complete and contain elevated concentrations of SSCOCs at significant volumes, they may adversely impact the in-water RA. Section 5 evaluates each of these pathways and determines whether they are sufficiently understood and controlled for the in-water RA to proceed.

SECTION 5: **Pathway Evaluations**

The pathways that are considered in this SA are organized into two groups:

1. Upland area pathways (Section 5.1)
2. In-water pathways (Section 5.2)

Each upland and in-water contaminant pathway is assessed to determine if it has the potential to adversely impact the RA in the Project Area after construction completion. Upland area pathways are those that have a potential to transport SSCOCs from surrounding upland properties to the in-water Project Area. Upland pathways were addressed on a parcel-by-parcel basis to help identify where data gaps may exist and where additional SCMs may be needed. In-water pathways are transport mechanisms within the river, such as resuspension and deposition that may cause sediment-containing SSCOCs to migrate and deposit on newly remediated surfaces. The AOC-SOW (EPA and WC Group, 2019) requires the SA Report to identify one of three potential outcomes for each pathway identified in the SOW:

1. Sources are **sufficiently controlled:** For this outcome, the sediment cleanup may proceed with reasonable confidence that the relevant recontamination potential is as minimal as possible.
2. Sources are **conditionally controlled:** The sediment cleanup may proceed providing certain additional controls or oversight are implemented in a reasonable timeframe or that information gaps are considered and filled to address uncertainties.
3. Sources are **not sufficiently assessed or controlled:** Specified areas of the sediment cleanup should not proceed until additional controls have been implemented and assessed for effectiveness.

The following sections evaluate these pathways, the associated sediment SSCOCs, or media-specific (surface water and groundwater) COCs and draw conclusions regarding the completeness of source control consistent with AOC-SOW requirements.

5.1 Upland Area Pathways

Three primary upland pathways—direct discharges (stormwater), groundwater, and riverbank erosion—have been identified as potential sources of recontamination to the Project Area. Each of these pathways is described and evaluated in the following subsections. The sources of data associated with the assessment of upland pathways, including riverbank sampling stations, monitoring wells, and outfalls, are shown in Figure 5-1. Determinations about the sufficiency of upland pathway SCMs and the identification of any existing data gaps are made at the end of each upland pathway's evaluation.

5.1.1 Direct Discharge (Stormwater) Pathway

Precipitation that falls onto upland areas either infiltrates downward to the groundwater table, runs off to the river as overland flow, or is transported to the Project Area through stormwater conveyance systems. Because of the potential for direct discharges to transport solids and water with SSCOCs at concentrations above CULs to the river, it is an important pathway in evaluating the potential for adverse impacts to the RA from the uplands.

5.1.1.1 Municipal Stormwater

One municipal outfall (OF-49) discharges stormwater to the in-water Project Area under the City's Municipal Separate Storm Sewer System program. OF-49 is located along the western edge of the Central Parcel of the WC Upland Facility (see Figure 5-1) and drains approximately 33 acres of land in North Portland. The majority of land use in this basin is residential (26 acres) with lesser amounts for commercial, roadways, and open space use. There are no ECSI sites within the OF-49 drainage basin or other known contaminated properties that discharge stormwater directly to this conveyance system. The drainage basin contributing to OF-49 is shown in Figure 4-17.

Stormwater discharge from the drainage basin is routed through a stormwater treatment facility located approximately 500 ft. upstream of OF-49. The City constructed this stormwater facility in 1995. The conveyance system also includes two small swales located along N. Decatur Street that were installed in 2011. All three swales are designed to infiltrate stormwater and reduce suspended sediment loading reaching the conveyance system and within the conveyance system.

In December 2013, the City produced the Municipal Stormwater Source Control Report for Portland Harbor (Municipal Report) (COP, 2013). This report describes the evaluation and findings for OF-49 and concluded there are no major sources of contaminants and that future discharges are unlikely to be a source of contaminants to the river. DEQ's Portland Harbor Upland Source Control Summary Report, which considered Basin 49, concluded that the potential for recontamination of sediment from municipal outfalls is low (DEQ, 2016).

5.1.1.2 Willamette Cove Upland Facility

Most of the WC Upland Facility immediately adjacent to the Project Area has pervious surfaces that allow for the infiltration of precipitation. Infiltration is aided by the predominance of sandy soils that comprise the ground surface and shallow soils. Observations of the infiltration capacity of soils in the WC Upland Facility led to the conclusion that the potential was low for overland flow to occur in any of the parcels (Apex, 2019). Within the WC Upland Facility, six potential outfalls have been identified through field reconnaissance. Five of these potential outfalls (WR-189, WR-190, WR-191, WR-192, and WR-193) are no longer active and may not be physically present. OF-49 is the only active outfall within the WC Upland Facility. In the most recent Portland Harbor Upland Source Control Summary Report (DEQ, 2016), DEQ excluded the stormwater pathway for the WC Upland Facility because there is no connection to a conveyance system, and overland flows have not been identified.

5.1.1.3 Crawford Street Area

Throughout the Crawford Street Area, packed gravels and asphalt are present at the surface (Rieke Consulting Services [Rieke], 2017). These materials typically have a poor infiltration capacity, which differs from the sandy soils in the adjacent WC Upland Facility. While there are no known outfalls in the Crawford Street Area, overland flows (stormwater runoff) have been observed in the southeastern corner of the parcel adjacent to Richmond Avenue (Bridgewater, 2015). Two stormwater runoff samples from the Crawford Street Area were collected in 2007 (Bridgewater, 2015). These samples showed concentrations of metals and PAHs above DEQ JSCS screening level values (DEQ, 2005). In the most recent Portland Harbor Upland Source Control Summary Report, the overland flow and stormwater pathways in this area were considered uncontrolled (DEQ, 2016).

Recently, assessments have been performed to determine the feasibility of constructing a stormwater infiltration pond in the southeast corner of the Crawford Street Area (Rieke, 2017). These assessments have determined that the surficial materials in the area of the proposed infiltration pond contained PAHs at concentrations above those in the DEQ clean fill criteria, but that deeper vadose-zone soils do not have chemicals at concentrations that are likely to impact groundwater (Rieke Consulting Services, 2017). If constructed, a stormwater infiltration pond could reduce the potential that stormwater runoff from the Crawford Street Area may migrate to the Project Area. However, infiltrating stormwater would likely raise the water table in the immediate area around the infiltration pond during periods of heavy rainfall, which would intermittently increase the rate of groundwater flux towards the Project Area.

5.1.1.4 Assessment of Direct Discharge Pathway

Consistent with the findings and conclusions of the Municipal Stormwater Source Control Report for Portland Harbor (BES, 2013) the municipal stormwater pathway for OF-49 is considered **sufficiently controlled**. The City has also implemented the Stormwater Management Manual (COP, 2016a) that promotes the use of green infrastructure, best management practices, and low-impact development in all City stormwater basins. Additionally, the City's Source Control Manual documents policies and requirements that govern the drainages and discharges to the municipal system (COP, 2016b).

At the WC Upland Facility, the direct discharge pathway is considered **sufficiently controlled.** The WC Upland Facility is not connected to the municipal stormwater system, so overland flow is the only potential direct discharge mechanism. However, an assessment of overland flow was performed and determined that soils at the WC Upland Facility had a high infiltration capacity and were not prone to generating overland flow (Apex, 2019). In the event the limited overland flows from the WC Upland Facility do occur, they will be addressed through the integration of the riverbanks into the RD process.

Stormwater from the Crawford Street Area discharges as overland flow to Richmond Avenue (Bridgewater, 2015). The end point of these discharges is unknown. The most recent Portland Harbor Upland Source Control Summary Report also concludes that the overland flow and stormwater pathways in this area are uncontrolled (DEQ, 2016). Until further information becomes available or SCMs are implemented, this pathway is considered **not sufficiently assessed or controlled.** The design of the in-water action should proceed; however, direct discharge SCMs in the Crawford Street Area should be implemented through the DEQ source control program and their effectiveness confirmed prior to RA implementation.

5.1.2 Groundwater Pathway

Groundwater occurs beneath all upland parcels near the Project Area and migrates slowly toward the Willamette River, which is the local and regional groundwater discharge zone. Groundwater may impact the ability of the in-water action to achieve RAOs in two ways: (1) contaminated groundwater with COC concentrations exceeding Table 17 CULs may discharge in the Project Area, and (2) "clean" groundwater may migrate through deeply buried contaminated sediment and transport contaminants at concentrations above Table 17 CULs to potential exposure areas through equilibrium chemistry and advection processes.

The depth of the water-bearing zone in the upland parcels range from 20 to 40 ft below ground surface (Apex, 2020). Near the Willamette River, groundwater levels are generally slightly higher than river stage and are influenced by tidal oscillations, which can temporarily reverse groundwater flows away from the river. The shallow groundwater zone is unconfined and the primary subject of this SA. This groundwater zone is most likely to be impacted by past activities (historical industry), and impacted shallow groundwater directly discharges to the Project Area. Because of the potential for groundwater to transport COCs to the river, it is an important pathway in evaluating the potential for adverse impacts to the RA from the uplands. The most recent JSCS Summary Report identified that groundwater source control investigations were in progress at both the WC Upland Facility and the Crawford Street Area (DEQ, 2016). The status and findings of these investigations are summarized below.

5.1.2.1 Willamette Cove Upland Facility

Extensive work has been done in the WC Upland Facility to assess the quality of groundwater and determine whether SCMs are needed to ensure the protection of the RA. Most recently, a Revised Groundwater Source Control Evaluation Report was prepared (Apex,2020). In this report, grab samples from temporary borings and monitoring well data collected throughout the WC Upland Facility were screened against the groundwater CULs that are included in Table 1-1. The results of screening groundwater samples collected in the WC Upland Facility showed the following:

- Metals (arsenic, cadmium, chromium, copper, lead, and zinc) exceeded groundwater CULs
- Total PAHs, total cPAHs, and individual PAHs exceeded groundwater CULs
- Total PCBs exceeded the groundwater CUL
- Total DDD exceeded the groundwater CUL
- Pentachlorophenol exceeded the groundwater CULs
- VOCs (benzene, chlorobenzene, tetrachloroethylene, and trichloroethylene) exceeded groundwater CULs

Groundwater showing the most exceedances of CULs occurs in the West Parcel and western portions of the Central Parcel of the WC Upland Facility. This area corresponds to the former log pond that was filled between 1973 and 1979 with undocumented materials derived, in part, from Portland Harbor upland sources, including the Arkema site. Because this area also contained concentrations of dioxin/furans in soil, groundwater samples from multiple wells in this vicinity were also analyzed for dioxin/furans, resulting in one detection in three rounds of sampling at MW-5 (see Figure 5-1).

In May 2020, DEQ issued comments on the Revised Groundwater Source Control Evaluation Report. In its comments, DEQ revised the list of groundwater COCs to the following:

- Metals (arsenic, lead, aluminum in the vicinity of MW-3)
- Pentachlorophenol in the West Parcel
- Dioxin/furans in the vicinity of MW-5 in the Central Parcel

It is important to note that total PAHs, total PCBs, DDD, benzene, and chlorobenzene are also retained because of their presence in groundwater. In its May 19, 2020 comment letter, DEQ eliminated the following chemicals as groundwater COCs:

- Metals (cadmium, copper, chromium, nickel, mercury, silver, and selenium)
- VOCs (tetrachloroethylene and trichloroethylene)

Based on the lack of a source to groundwater on the East Parcel and non-detect results in the well nearest to the East Parcel, DEQ eliminated dioxin/furans as COCs for groundwater on the East Parcel. However, EPA requested that the lack of dioxin/furan groundwater data for the East Parcel be identified as a data gap (see Sections 7.4 and 8.1).

5.1.2.2 Crawford Street Area

A limited amount of work has been done to assess groundwater conditions within the Crawford Street Area. In 2015, a focused subsurface investigation was performed on the Crawford Street Area property (Evren Northwest, 2016). Fourteen groundwater samples collected during this investigation and before were analyzed for Volatile Organic Compounds (VOCs), PAHs, and TPH. Most constituents were not detected in any samples, but the detection limits (DLs) achieved were well above groundwater CULs. Toluene was the only groundwater COC detected during this sampling, but its maximum concentration was below the CUL. In 2017, three groundwater samples were collected in the southeastern corner of the Crawford Street Area and analyzed for VOCs as part of an infiltration pond study (Rieke, 2017). The VOC results from these samples were screened against 17 groundwater CULs. There were no exceedances. In light of the lack of groundwater data, the DEQ has requested that additional sampling be performed. A Work Plan has been submitted to address this DEQ request.

5.1.2.3 Assessment of Groundwater Pathway

There is inherent uncertainty in assessing impacts to an in-water RA resulting from discharging groundwater because of the complexities related to chemical fate and transport and the current lack of dioxin/furan congener data in groundwater and porewater. Given the available information presented in the Revised Groundwater Source Control Evaluation Report (Apex, 2020) the groundwater pathway in the WC Upland Facility is considered **not sufficiently assessed or controlled.** Based on the limited information available within the Crawford Street Area, the groundwater pathway is considered **not sufficiently assessed or controlled.**

In recognition of the need for additional assessment by upland parties, the groundwater approach for the Phase I PDI will focus on assessing groundwater at potential in-water exposure points in the Project Area by collecting porewater samples in the areas targeted for capping. For the Phase I PDI, the porewater samples will be analyzed for chemicals with RAL exceedances in the Project Area (PCBs, PAHs, and dioxin/furans). This approach will provide data that will feed into the sediment cap design (thickness and amendments). If the results of the Phase I PDI porewater sampling indicates that exposure to these COCs cannot be adequately controlled through the in-water design, it will be the responsibility of upland parties to mitigate adverse concentrations through appropriate upland groundwater remedies. Other Table 17 groundwater CULs, such as metals, and their impacts on the in-water remedial design will be assessed when more information is available from the upland source control work.

These conclusions are uncertain and it is recommended that additional groundwater chemistry and hydraulic gradient data be collected throughout the WC Upland Facility and Crawford Street Area to increase confidence in these outcomes. If information gathered during the PDI indicate that the groundwater pathway could adversely impact the RA, the groundwater pathway may be addressed during RD or SCMs may be implemented.

5.1.3 Riverbank Erosion Pathway

The EPA Guidance for Riverbank Characterization and Evaluation at the Portland Harbor Superfund Site (EPA, 2019a) defines riverbanks as the top of bank (slope break) to -2 ft CRD. In accordance with the AOC (EPA and WC Group, 2019), the Willamette Cove riverbank is within the Project Area The top of bank was determined to be approximately 27 feet CRD (equivalent to 32 feet North American Vertical Datum of 1988) during the upland Willamette Cove Feasibility Study and Source Control Evaluation for all riverbanks within the WC Upland Facility (Apex, 2019). For the purposes of this SA, this approximate top-of-bank elevation is also applicable to the adjacent Crawford Street Area since the upland parcels are similar in location and topography.

Riverbanks are subject to erosion through overland flow, slope failures, and the erosive forces of the river. If SSCOCs are present in soil and debris within the riverbanks, they will be mobilized through these erosive processes, transported to the river, and potentially adversely impact the RA. The most recent JSCS Summary Report identified that riverbanks associated with the WC Upland Facility and Crawford Street Area are uncontrolled. Based on this determination, DEQ determined that SCMs will be needed, and the stabilization of riverbanks within the WC Upland Facility should be integrated with the in-water RA (DEQ, 2016). Since the 2016 JSCS Summary Report, extensive work has been done in the Crawford Street Area to assess the physical and chemical condition of riverbanks and inform source control decisions associated with them (Cascadia Associates, 2020).

5.1.3.1 Willamette Cove Upland Facility

Of the riverbanks associated with the WC Upland Facility, only the riverbanks within the East and Central Parcels were identified to be contaminated in the Portland Harbor Superfund Site ROD (EPA, 2017).

However, it should be noted that there is a general absence of data from the West Parcel riverbank due to the presence of extensive large riprap. In the upland Feasibility Study and Source Control Evaluation for the Willamette Cove Upland Facility, a riverbank soil source control evaluation was performed (Apex, 2019). This evaluation assessed the potential for erosion to mobilize riverbank materials through slope failure, overland flow, and wave action. The results of the erosion evaluation concluded that the riverbank in the WC Upland Facility has the following physical characteristics:

- The riverbank is primarily composed of sand and silt protected by riprap, boulders, and concrete.
- Riverbanks had varying slopes, but many were steep with one horizontal to one vertical (1H:1V) slopes.
- Slope creep is occurring, as indicated by curved tree trunks in the East Parcel.
- Erosion of riverbank soils is occurring in the East Parcel in areas that lack vegetation due to wave action from boat wakes.
- Erosion of riverbanks in the Central Parcel is occurring due to steep slopes, as indicated by scarps and exposed soils.
- Erosion of the riverbank along the West Parcel is possible during high-energy flow events.
- The potential for overland flow is low due to the high-infiltration capacity of the upland soils.

The riverbank evaluation also assessed the chemical characteristics of riverbank soils that were determined to be erodible. The riverbank data were then screened against RALs, PTW thresholds, and riverbank CULs. This process identified the following SSCOCs as exceeding RALs, PTW thresholds, or CULs:

- Metals (cadmium, copper, lead, mercury, and zinc) exceeded CULs.
- TPH-diesel exceeded the CUL.
- Total PAHs and total cPAHs exceeded CULs.
- Total PCBs exceeded the RAL, PTW threshold, and CUL.
- Dioxin/furan congeners exceeded RALs, PTW thresholds, and CULs.

The exceedances of CULs for metals, PAHs, and TPH-diesel occurred throughout the WC Upland Facility. Total PCBs exceedances of the RAL, PTW threshold, and CUL occurred along the western border of the East Parcel. PeCDD exceedances of the PTW threshold occurred in the Central Parcel, but data was not available elsewhere.

5.1.3.2 Crawford Street Area

Riverbanks associated with the Crawford Street Area are not part of the Project Area but are relevant to the SA due to their location adjacent to it. The Crawford Street Area riverbanks were recently assessed as part of the Leave Surface Characterization Report for the Crawford Street Property (Cascadia Associates, 2020). The Leave Surface Characterization Report assessed the chemical characteristics of surface and subsurface riverbank soils in the Crawford Street Area in support of SCMs planned for the greater Crawford Street Property. It is our understanding that potential source control measures at Crawford Street include bank lay back and capping. In the Leave Surface Characterization Report the riverbank data were screened against the RALs, PTW thresholds, and riverbank/sediment CULs. Dioxin/furan congeners were assessed in a subset of the samples. This process identified the following SSCOCs as exceeding RALs, PTW thresholds, or CULs:

- Metals (cadmium, lead, mercury, and zinc) exceeded CULs.
- Total DDx exceeded the RAL and CUL.
- TPH-diesel exceeded the CUL.

- Total PAHs exceeded the RAL and CUL.
- Total cPAHs exceeded the CUL.
- Total PCBs exceeded the RAL, PTW thresholds, and CULs.
- Dioxin/furan congeners RALs, PTW thresholds, and CULs.

A bank erodibility assessment was performed in 2017, a few years prior to the Crawford Street leave surface characterization work. This assessment used the BEHI developed by Rosgen to categorize and rank the erodibility of different riverbank cross-sections (Rosgen, 2006). Results of this process indicated that riverbank cross-sections within the Crawford Street Area had BEHI ratings of "moderate," and one area of overland flow was observed (Inter-Fluve, 2017). This evaluation did not include the extensive soil boring data collected during the 2018–2019 leave surface characterization sampling, and therefore the conclusion from the 2017 assessment is subject to potential revision by DEQ.

5.1.3.3 Assessment of Riverbank Erosion Pathway

Based on the results of the riverbank source control evaluation and plans to integrate the riverbank into the Project Area RD the riverbank pathway in the WC Upland Facility is considered **conditionally controlled**. The riverbank associated with the WC Upland Facility will be incorporated into the RD process for the RA as indicated in the AOC-SOW (EPA and WC Group, 2019). During RD, additional riverbank sampling may be necessary to assess the distribution of all SSCOCs throughout the WC Upland Facility riverbank and determine the riverbanks physical characteristics for RD purposes. This integration of the riverbank in the WC Upland Facility into the RA is essential to mitigate the potential for adverse impacts from future riverbank erosion. To incorporate the WC Upland Facility into the RD, a high-resolution topographic survey may be needed. These data will allow for the incorporation of the riverbank into the recently updated bathymetric survey dataset giving complete coverage of the Project Area.

Based on the Leave Surface Characterization Report and BEHI assessment for the Crawford Street Property, the riverbank pathway for the Crawford Street Area is considered **not sufficiently assessed or controlled**. Due to the presence of SSCOCs in the Crawford Street Area riverbank above RALs and PTW thresholds SCMs will be needed. If not addressed through SCMs, adverse impacts to the RA from riverbank erosion would be most significant for shallow regions of the Project Area adjacent to the riverbanks of the Crawford Street Area that are eroding. While the Crawford Street Area riverbank is not part of the Project Area, the RD will consider the actions planned for the Crawford Street bank during RD to avoid adversely impacting that upland source control measure.

5.2 In-Water Pathways

Four primary in-water pathways—upriver SPM, sediment resuspension, groundwater advection, and existing structures and overwater activities—have been identified as potential sources of recontamination in the Project Area. Each of these pathways is described in detail in the following subsections. Historical data points for sediment traps, porewater, and surface water sampling previously conducted in the Project Area are shown on Figure 5-2. Determinations about the sufficiency of each in-water pathway SCM and the identification of any existing data gaps are made at the end of each in-water pathway's evaluation.

5.2.1 Upriver Suspended Particulate Matter Pathway

SPM entering the Project Area from upriver may contain SSCOCs. Depending on the hydrodynamic conditions in the Project Area, incoming SPM with SSCOC concentrations above RALs, PTW thresholds, and CULs can be redeposited in the Project Area and adversely impact the RA. To evaluate this pathway, the primary areas of interest are those where incoming SPM may be deposited within the Project Area. Based on changes in the sediment bed elevation, measured between 2004 and 2018 as shown in Figure 4-19 (AECOM and Geosyntec, 2019), the inner Cove area appears to be a moderately to highly depositional environment. This aligns with the low-energy hydrodynamic setting in this area. Downriver of the inner Cove, the hydrodynamics change to a higher energy environment, and the resulting sediment bed is either in dynamic equilibrium or is slightly erosional. These areas are not subject to adverse impacts from SPM deposition. For that reason, the inner Cove is the focus of the upriver SPM evaluation. One confounding factor to evaluating SPM transport is the periodic reversals in river flow direction due to tidal influences near the Project Area (see Section 4.5). However, these flow reversals are low-velocity, limited-duration events and therefore are not considered to be of significant factors in the mobilization and deposition of SPM.

5.2.1.1 Potential Sources of Contaminated SPM

SPM could originate from many areas upriver of the Project Area (see Figure 4-18). The Project Area lies on the eastern bank of the Willamette River near the center of the Portland Harbor Superfund Site. Upriver of the Project Area, areas with contaminated sediment that are subject to resuspension due to natural or anthropogenic events are a potential source of contaminated SPM.

5.2.1.2 Existing Data Evaluation

SMAs in the Portland Harbor Superfund Site that are not remediated may be sources of SPM with chemical concentrations above RALs, PTW thresholds, and CULs to the Project Area. While the potential for adverse impacts to the RA from upriver SPM appears low due to hydrodynamic dispersion, settling, and mixing, a further evaluation was conducted comparing SSCOC concentrations in recent surface sediments collected from the depositional area within the inner Cove to CULs and RALs. Sample locations for this evaluation are shown in Figure 5-2. This evaluation showed that there are surface sediments in recently deposited materials (within the last 10 to 15 years) that contain SSCOCs above CULs and RALs for multiple constituents. While this approach cannot make a definitive connection to SPM transport from areas outside of the Project Area, the finding is one line of evidence supporting the potential for adverse impacts to the RA from newly deposited SPM.

Sediment trap sampling in the vicinity of Willamette Cove was not conducted during the 2018 baseline sampling; the only SPM data in this area was collected in 2007 during the harbor wide RI. The 2007 data consists of two SPM samples collected at one location in the Project Area, as shown in Figure 5-2. This historical data was screened against RALs, PTW thresholds, and sediment CULs to identify SSCOC exceedances. Since the data was collected prior to the completion of many upriver source control measures, the assessment is considered conservative. Using this older data, this screening process identified the following SSCOCs as exceeding RALs, PTW thresholds, or CULs in SPM being deposited in the Project Area:

- Chlordane exceeded the CUL in both samples.
- Total DDx exceeded the CUL in one sample.
- Total PCBs exceeded the CUL in both samples. Two samples had total PCB Aroclors above the RAL, and one sample had total PCB congeners above the RAL.
- TPH-diesel exceeded the CUL in one sample.

5.2.1.3 Assessment of Upriver SPM Pathway

Based on the ongoing implementation of RAs in the Portland Harbor Superfund Site, upriver SPM is not anticipated to adversely impact the RA in the Project Area. However, surface sediment and SPM data collected from within the Project Area show exceedances of RALs and CULs for multiple SSCOCs. Because of the uncertainty around SSCOC concentrations of SPM being deposited in the Project Area, the upriver SPM pathways is considered **conditionally controlled** assuming source control measures and remedial actions upriver are undertaken. The potential for impacts from SPM deposition in the Project Area should decrease if the Portland Harbor Superfund Site ROD is implemented in a timely manner at upstream SMAs. While the potential for SPM transported from upriver SMAs to adversely impact the RA is low, it is recommended that sediment trap data be collected to confirm this determination.

5.2.2 Sediment Resuspension Pathway

The resuspension of sediments within the Project Area could occur due to natural and anthropogenic forces. Natural forces such as waves and high-energy river flows may scour portions of the Project Area. Anthropogenic forces from recreational boat propellers may resuspend sediments within the inner Cove despite its depositional patterns. Once suspended, these sediments may mix with surrounding sediments, become entrained in currents, or settle onto remediated surfaces within and outside of the Project Area. The resuspension pathway is one of redistribution, which differentiates it from other pathways in this report that involve the transport of new sediments, SSCOCs, and media-specific COCs to the Project Area.

5.2.2.1 Existing Data Evaluation

Due to the lack of current or planned use of the Project Area by large vessels and the planned RA consisting of capping and dredging, the assessment of the sediment resuspension pathway is limited to surface sediments (top foot or 30 cm) within the Project Area. Sediments below the surface do not have a reliable resuspension mechanism and will be either removed or further isolated in the post-RA future. The combined surface sediment RAL and PTW threshold exceedances for the Project Area can be seen in Figure 4-2. Areas with surface sediment RAL and PTW exceedances would have the greatest potential adverse impact on the RA if they became resuspended.

5.2.2.2 Assessment of Sediment Resuspension Pathway

Based on the low likelihood of anthropogenic resuspension and RA plans for capping and dredging surficial sediments, the resuspension pathway is considered **sufficiently controlled**. It is recommended that the RA proceed based on reasonable confidence that the relevant recontamination potential is as minimal as possible. Once the RA is constructed, ICs should be put in place to limit activities that could lead to the resuspension of sediments within the Project Area.

5.2.3 Groundwater Advection (Porewater) Pathway

The groundwater advection pathway relates to the interstitial water contained within sediment commonly referred to as porewater. Advected groundwater is a potential exposure medium to benthic receptors and is a mechanism that may transport SSCOCs from buried contaminated sediment to surface sediment, remediated surfaces (caps), and surface water. Through the complex geochemical processes, SSCOCs in migrating groundwater may desorb near the sediment/surface water interface, creating a potential source of recontamination to shallow sediments and caps. The complex partitioning process is difficult to simulate in a model without empirical data to support the calculations.

5.2.3.1 Existing Data Evaluation

The ability to assess the groundwater advection pathway within the Project Area is limited due to the absence of available data. Only one porewater sample has been collected in the Project Area that was collected in 1997 and analyzed for metals only. The sample location can be seen on Figure 5-2. Many of the DLs in this sample were above-groundwater CULs, making it of limited use for this SA. The results for this sample were screened against the groundwater CULs, and arsenic and lead exceeded the CUL.

5.2.3.2 Assessment of Groundwater Advection Pathway

Based on the known groundwater contamination in the West Parcel and lack of porewater data in the Project Area, the groundwater advection pathway is considered **not sufficiently assessed or controlled**. While impacts to the RA may be low because the primary SSCOCs do not readily partition into the dissolved phase, it is recommended that porewater chemistry and seepage data be collected for the following objectives:

- Determine if the groundwater advection pathway could transport SSCOCs to surface sediments and engineered caps at concentrations that would adversely impact the RA
- Inform the sediment cap design (thickness and amendments)

If the potential for adverse impacts to the RA are identified through porewater sampling, they may also be mitigated, in part, by the implementation of groundwater SCMs in the WC Upland Facility and, if needed based on further groundwater assessment, at Crawford Street Area.

5.2.4 Existing Structures and Overwater Activities Pathways

The Project Area does not contain any existing overwater structures, such as piers and docks. Throughout the Project Area, there are remnant piles from historical operations and dock structures, multiple sunken vessels, and the M&B cap adjacent to the Project Area that will be considered in this evaluation. Chemicals that could be present on these structures and the adjacent BNSF railroad bridge (e.g., paint, hydrocarbons, creosote, and PCBs) have the potential to adversely impact the RA through their release via mechanical processes, such as abrasion or M&B cap failure, or chemical processes, such as leaching. If these processes are occurring, it may be reflected in surface sediment and SPM concentrations within the Project Area. Since there are no existing structures and the remnant piles and debris will be assessed during RD, no adverse impact to the RA is expected. The most recent evaluation of the M&B cap's performance was conducted in support of the fourth 5-year review (EPA, 2016b). This evaluation determined that the sediment remedy remained protective of human health and the environment consistent with the cleanup goals established in the M&B ROD (EPA, 1996). However, the cleanup goals in the M&B ROD are often significantly higher than the Portland Harbor Superfund Site CULs (EPA, 2017). For this reason, the M&B cap may not be projective of RA in the Project Area and its construction may have mobilized SSCOCs to the Project Area at concentrations below M&B site cleanup goals above Portland Harbor Superfund Site criteria despite being determined to be functioning as intended.

The existing structure pathway is considered **conditionally controlled** since the cleanup of the M&B site was conducted prior to and separate from the Portland Harbor Superfund Site. The M&B cap is functioning as intended (EPA, 2016b). However, it is recommended that the performance of the M&B cap continue to be monitored on its normal schedule by the EPA and DEQ to ensure that it does not become compromised and that the monitoring data be suitable for assessment against Portland Harbor Superfund Site RALs, PTW thresholds, and CULs.

Overwater activities in the Project Area are limited to small (less than 30 ft) boat traffic and moorage within the cove. Spills or releases from these noncommercial boats are not considered to be potential sources of SSCOCs that could cause adverse impacts to the RA. For this reason, overwater activities are considered **sufficiently controlled** for the RA to proceed. It is recommended that the RA include ICs restricting navigation in the Project Area.

SECTION 6: **Future Conditions**

6.1 Future Remediation

The following sections assess the degree to which future upland and in-water uses may affect the proposed RA.

6.1.1 Upland Remediation

The WC Upland Facility recently completed an upland feasibility study (Apex, 2019). The study identified excavation and disposal of hot spot soils in western portions of the Central Parcel, consolidation of soils with COC concentrations above human health criteria from all three parcels in the East Parcel, and capping soils with COC concentrations above ecological risk levels. ICs would also be implemented to identify the presence of the soil consolidation and capping areas. Once implemented, this RA should be effective at managing site risks associated with upland contaminant pathways. However, it should be noted that the proposed Willamette Cove upland soil RA does not include an RAO to prevent contaminants from leaching into groundwater, leaving an unknown potential for continued leaching of contamination to groundwater.

The Crawford Street Area, as defined in the AOC (EPA and WC Group, 2019), has been investigated to characterize stormwater and riverbank materials (Rieke, 2017; Cascadia Associates, 2020). Using information gathered through these investigations, designs for stormwater infiltration ponds and riverbank SCMs have been proposed. If these SCMs are implemented, they could effectively manage site risks associated with the direct discharge and riverbank erosion upland contaminant pathways in the Crawford Street Area.

6.1.2 In-Water Remediation

Within the Project Area, widespread remediation will occur using a variety of technologies (e.g., dredging, capping, and MNR) (EPA, 2019a). These efforts will improve environmental conditions within the Project Area by lowering chemical concentrations below RALs and PTW thresholds and potentially removing physical hazards (e.g., derelict vessel, remnant piles, and miscellaneous debris). In the northeastern portions of the Project Area, habitat may be restored in conjunction with the RA.

In-water remediation efforts upriver of the Project Area will improve environmental conditions and bolster RA performance. Once the RAs that improve sediment and water quality upriver of the Project Area are completed, incoming SPM and surface water quality will be further improved. Even when implementing basin-wide remediation efforts, achieving CULs for COCs with naturally high background concentrations, such as arsenic (DEQ, 2013), or regionally elevated concentrations, such as bis(2-ethylhexyl) phthalate and dioxin/furan congeners, would be challenging (LWG, 2016). The portions of the Project Area adjacent to the M&B cap are depositional (AECOM and Geosyntec, 2019). For this reason and those identified in Section 5.2.1, future concentrations of SSCOCs in SPM are important to the long-term performance of the Project Area RA.

6.2 Changes in Land Use

Currently, the WC Upland Facility is zoned as open space, and the Crawford Street Area is zoned for industrial use. Access to the M&B site and the BNSF easement are restricted. Areas of the St. John's georegion that contribute stormwater to OF-49 are primarily zoned for residential and commercial development. In the future, there are likely to be changes in the land use of properties immediately adjacent to the Project Area and in the portions of the St. Johns georegion that drain to OF-49. These changes may influence the performance of the RA.

Future changes in upland land use in the WC Upland Facility may include the development of a greenway trail, spur trails, river viewing areas, and preservation as open space (Alta, 2010; Metro, 2014). These changes will bring increased public access to the area and create opportunities for recreation and beneficial use of the WC Upland Facility parcels and in-water Project Area. To balance public access with the need to be protective of human health, ICs will be implemented. These ICs will serve to inform the public about site risks and protective features to limit impacts to the RA and reduce the likelihood of human exposures (Apex, 2020). To complement upland remediation efforts discussed in Section 6.1.1, there will also be additional planting of native species, which will work to further reduce the likelihood of upland runoff and erosion, thereby reducing the risk posed by upland pathways to the RA.

Future use of the Crawford Street Area is unknown. If no significant changes occur in the Crawford Street Area, conditions should continue to improve only if SCMs are implemented as needed to address overland direct discharges, riverbank erosion, and groundwater pathways.

Changes in development of the areas contributing stormwater to OF-49 will likely bring more density since vacant land development alone cannot address the region's housing needs (Metro, 2018). St. Johns has also been designated a town center in the 2040 Growth Plan, which defines the form of regional growth further supporting development in the area (Metro, 2014). The City's programmatic SCMs will continue to be implemented in these areas, including the use of green infrastructure and stormwater best management practices that the City has committed to (COP, 2016a). Because of the City's efforts to manage and improve stormwater quality, the risk posed by the direct discharge pathway may be reduced by future changes in land use and development.

6.3 Changes to Waterway Use

Future changes to the use of the Willamette River surrounding the Project Area may include increased vessel traffic and recreational use. Once RAs are implemented for the Portland Harbor Superfund Site, the U.S. Army Corps of Engineers may dredge the existing navigation channel to a previous maintenance depth of -40 feet CRD (EPA, 2017). This work will enhance access to marine terminals in the Willamette River and thereby create incentives to increase vessel traffic. By reclaiming the navigation channel's historical depths, larger and more powerful vessels may use the Willamette River. This change in waterway use has the potential to increase wave action- and propeller wash-related erosional forces. Increased use of the Willamette River by recreational boaters is likely to occur due to increases in the regional population (Metro, 2014) and post-remediation revitalization of the Portland Harbor reach of the Willamette River. These recreational vessels could also contribute to the erosive forces in the Project Area by increasing wave action along the shoreline and the disturbance of shallow sediments if ICs are not put in place. Additionally, the plans for Willamette Cove call for restoration of portions of the Project Area and preservation of the upland as greenspace.

6.4 Climate Change

Climate change has the potential to affect the RA (EPA, 2019c). The primary mechanisms for these effects include the following:

- Increased seasonal river flows in the Willamette and Columbia Rivers
- Increased peak storm flows in the Willamette and Columbia Rivers
- Reduced summer flows in the Willamette and Columbia Rivers due to changes in snowpack (Mote et al., 2018) and water use
- Sea level rise impacts to water levels in the Willamette and Columbia Rivers
- Changes to storm patterns and severity that lead to increased overland flow and erosion

Changes in-river flows and sea level rise have the potential to impact RAs that are not developed with resiliency in mind. These changes may alter the elevations in the Project Area that will be subject to erosive forces from in-river flows, wave action, and propeller wash. During the design process, assessments of the impact that future flow conditions and sea level rise may have on the RA will be made in accordance with EPA guidance. The results of these assessments will be used to develop a resilient and stable design for the final remedy that will be protective under predicted future conditions.

Changes in storm patterns and severity could lead to overland flow and erosion of surficial soils that, if left uncontrolled, could impact the RA. Currently, it is believed that soils in the WC Upland Facility are well suited to infiltration and unlikely to become saturated to the point where overland flow occurs (Apex, 2020). Within the Crawford Street Area, there are known points of overland discharge when storm events produce enough precipitation (Rieke, 2017). If future storm patterns produce increased amounts of precipitation over shorter durations, the likelihood that upland soils will have their infiltration capacities exceeded will increase. Due to the plans for remediation in the WC Upland Facility, erodible soils will likely consist of clean materials and should not impact the RA if overland flows occur in the future.

6.5 Potential Impacts from Future Conditions to the Project Area

Future conditions are largely beneficial for the RA that will be taken in the Willamette Cove Project Area. Planned upland remediation and SCMs will further reduce the potential impact of upland pathways on the RA. In-water remediation efforts in Portland Harbor Superfund Site and the downtown reach of the Willamette River will reduce COC concentrations of settling particulate matter and surface waters flowing through the Project Area. Increased use of green infrastructure and stormwater best management practices will also reduce the chemical concentrations and volumes of direct discharges to the Project Area.

Potential impacts to the RA that may occur due to future conditions are generally related to changes in waterway use and climate change. These changes will primarily increase the erosive forces acting on portions of the Project Area that will be subject to wave action and potential propeller wash, which can be accounted for in the RD process.

SECTION 7: **Conclusions**

The SSCOCs in the Project Area are detailed in Section 3. This contamination is the result of historical releases and hydrodynamics of the Willamette River. Over time, sources of contamination have been eliminated through the implementation of the Clean Water Act in 1972, elimination of high-risk persistent chemicals (e.g., PCBs, chlorinated pesticides, and butyltins), upland SCMs, and improved management practices. The goal of the Willamette Cove RA is to reduce the risk posed by sediments with chemical concentrations above RALs and PTW thresholds identified in the Portland Harbor Superfund Site ROD. To achieve this goal, the proposed remedy relies on a variety of technologies, including dredging and capping. Areas with sediment concentrations below RALs but above CULs will be addressed through the application of MNR, which relies on natural attenuation and isolation to reduce exposure concentrations over time.

7.1 Sufficiency Assessment Outcomes

The results of this SA for the upland and in-water pathways are presented in Table 7-1. In addition to these pathways, Table 7-1 presents sufficiency assessment outcomes for two adjacent properties – the M&B site and the BNSF railroad bridge. The following is a summary of the SA outcomes:

- Upland area pathways
  - Direct discharges
    - Municipal (OF-49) – **Sufficiently controlled**
    - WC Upland Facility – **Sufficiently controlled**
    - Crawford Street Area – **Not sufficiently assessed or controlled**
  - Groundwater
    - WC Upland Facility – **Not sufficiently assessed or controlled**
    - Crawford Street Area – **Not sufficiently assessed or controlled**
  - Riverbank erosion
    - WC Upland Facility – **Conditionally controlled**
    - Crawford Street Area – **Not sufficiently assessed or controlled**
- In-water pathways
  - Upriver SPM – **Conditionally controlled**
  - Sediment resuspension – **Sufficiently controlled**
  - Groundwater advection – **Sources are not sufficiently assessed**
  - Existing structures – **Sources are not sufficiently assessed**
  - Overwater activities – **Sufficiently controlled**
- Surrounding Properties
  - McCormick & Baxter – **Sources are not sufficiently assessed**
  - BNSF Railroad Bridge – **Sources are not sufficiently assessed**

Upland pathway outcomes indicate a need for additional characterization and implementation/completion of SCMs for groundwater and riverbank erosion pathways. Work on the upland pathways is critical to the overall success of the in-water remedy by meeting RAOs for media other than sediments. Work on these pathways will be completed by parties other than the WC Group, under the oversight of DEQ. The in-water pathway outcomes indicate a need for ongoing monitoring of SPM entering the Project Area, characterization of advected groundwater, and an assessment of the potential for existing structures to impact the RA. This work will be completed by the WC Group as part of the RD. Any work required to fill data gaps associated with surrounding properties will be the responsibility of property owners under the DEQ Source Control Program or by DEQ and EPA at the M&B site.

7.2 Implications for the Selected Remedy

This evaluation identifies pathways of SSCOCs to the Project Area that have the potential to adversely affect the RA. To understand the mechanisms and mitigate these recontamination risks, predesign sampling and further technical evaluation of the groundwater and riverbank erosion pathways are warranted. Since upland pathways are involved with source control efforts or will be integrated into the in-water RD (e.g., riverbank erosion), the potential impact to the RA from these pathways is expected to be low. However, if upland pathways are not controlled they could adversely affect the RA.

In-water contaminant pathways are less likely to have adverse impacts on the RA. The upriver SPM, groundwater advection, and existing structures pathways were not sufficiently assessed due to a lack of data. Given the potential impacts to the RA from these pathways, the risks or adverse impacts to the RA are unknown and may warrant further investigation by the appropriate parties.

7.3 Sufficiency Assessment Limitations

This SA was completed with the information that was readily available. As such, there are limitations to the conclusions that could be drawn. Some of the limitations that should be addressed through future investigations, organization, and processes include the following:

- Incomplete and old data sets for numerous upland and in-water pathways
- Numerous samples with DLs above the relevant CUL
- Uncertainty around the impacts of climate change
- Uncertainty about the rate at which upriver RAs and SCMs will be implemented

Many of these limitations will be assessed through the forthcoming PDI or during the RD process.

7.4 Identified Data Gaps

Multiple data gaps were identified through the SA evaluation and are summarized below.

- Incomplete chemical and physical data for the groundwater pathway in the WC Upland Facility and Crawford Street Area
- Incomplete data to support the integration of the WC Upland Facility riverbank into the RD
- Incomplete SPM data in the Project Area to ensure upriver contributions are controlled
- Incomplete chemical and seepage data for the groundwater advection pathway in the Project Area
- Incomplete information about the conditions along the BNSF rail line, including the BNSF railroad bridge
- The M&B site is managed under a separate ROD with differing RAOs and CULs. Because of these differences in cleanup standards, the potential adverse impacts to the RA at Willamette Cove are not known.
- The lack of dioxin/furan groundwater data in the East Parcel of the WC upland area
- River level and sea level rise modeling (EPA, 2019c)

SECTION 8: Recommendations and Next Steps for Remedial Design

Concurrent with this SA and as part of the requirements established by the AOC-SOW (EPA and WC Group, 2019), the WC Group is preparing a PDI Work Plan that builds on the historical in-water and upland investigations. The PDI Work Plan describes the objectives, approach, and schedule for the Willamette Cove PDI. This SA identified the need for the proposed RA and SCMs to address upland and in-water contaminant pathways that may adversely affect the RA after construction. To assist in the planning of the PDI and RD, the outcomes of the SA for each upland and in-water pathway were identified in Section 7.1, and existing data gaps were identified in Section 7.4. The following sections lay out the proposed resolutions to data gaps related to pathways that were not sufficiently assessed and additional SCMs that may be implemented to address pathways that are not sufficiently controlled or conditionally controlled.

8.1 Data Gap Resolution

The data gaps identified in Section 7.4 will be addressed through the Willamette Cove RD or by other parties under separate regulatory programs (e.g., DEQ Source Control and EPA/DEQ performance monitoring at the M&B site). A summary of data gaps and responsible programs is presented in Table 7-2.

8.2 Additional Source Control Measures and Remedial Design Integration

Numerous pathways were determined to be conditionally controlled through the evaluation of existing data and site-specific assessments. These pathways may require additional SCMs or integration into the RD to ensure that the RA is not adversely affected. The following additional SCMs may be necessary based on this evaluation:

- WC Upland Facility
  - Groundwater SCMs for approximately the western half of the WC Upland Facility, if groundwater advection and upland groundwater data indicate that the pathway is not controlled
- Crawford Street Area
  - Direct discharge SCMs to prevent overland flows to Richmond Avenue
  - Groundwater SCMs, if groundwater advection and upland groundwater data indicate that the pathway is not controlled
  - Riverbank erosion SCMs

Contaminant pathways may also be integrated into the RD to address potentially adverse impacts they may have on the RA. The Project Area extends to the top of the bank throughout the WC Upland Facility, and the RA will be designed and implemented to stabilize the bank and minimize scour and erosion. Potential adverse effects of groundwater advection through contaminated sediment will be mitigated through the design of a protective sediment cap. Designing this cap will require additional data, such as seepage rates and porewater concentrations.

- Riverbanks throughout the WC Upland Facility will be integrated into the RD and RA consistent with EPA guidance (EPA, 2019a).
- For groundwater, it is important to recognize that multiple ongoing upland groundwater pathway investigations are currently in progress under DEQ authority. The outcome of this work is important to the in-water RD to ensure that RAOs related to groundwater will be met within the Project Area.

Groundwater discharges to the Project Area will be evaluated during the Phase I PDI through porewater sampling. If adverse impacts from groundwater discharging to the Project Area cannot be mitigated through the design (e.g., sediment cap thickness and amendments), it will be the responsibility of the upland parties to prevent adverse discharges by implementing groundwater source control actions. Additionally, data gaps associated with groundwater, beyond the porewater sampling identified in the PDI Work Plan, are the responsibility of upland parties.

- ICs will be implemented as appropriate to manage the resuspension of surficial sediments within the Project Area due to anthropogenic forces.

SCM implementation should be completed prior to or simultaneously with the RA. SCMs are anticipated to be effective in addressing upland contaminant pathways to the Project Area. The effectiveness of these SCMs will be assessed through the implementation of a long-term monitoring program after the RA. Pathways integrated with the RD process will be addressed during construction of the RA. The effectiveness of the RA in addressing these pathways will also be assessed through a long-term monitoring program.

Completion of ongoing SCM and PDI activities lies within the jurisdiction and authority of the DEQ and EPA. As additional information about contaminant pathways to the Project Area becomes available, it will be assessed and incorporated into the RD to determine whether the RA can proceed, if viable contaminant pathways remain, and how they may be integrated into the RD. The WC Group is proceeding with the RD, understanding that this work is ongoing and acknowledging the limitations and uncertainties identified in Section 7.3.

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TABLES

Table 1-1
Portland Harbor CULs, RALs, and PTW Thresholds

Parameter	Riverbank Soil/Sediment CUL[1]	Sediment				Groundwater CUL[1]	Surface Water CUL[1]
		Sitewide RALs[2]	PTW Thresholds[2]	Natural Background (DEQ, 2013)	Downtown Reach Background (LWG, 2016)		
Metals and Inorganics (mg/kg)							
Arsenic	3	--	--	8.8	6.2	0.018	0.018
Cadmium	0.51	--	--	0.63	--	0.091	0.091
Chromium	--	--	--	--	--	11	100
Copper	359	--	--	34	99	2.74	2.74
Cyanide	--	--	--	--	--	4	4
Lead	196	--	--	79	--	0.54	0.54
Mercury	0.085	--	--	0.23	--	--	--
Perchlorate	--	--	--	--	--	15	15
Zinc	459	--	--	180	294	36.5	36.5
Volatile Organic Compounds (µg/kg)							
1,1-Dichloroethene (1,1-DCE)	--	--	--	--	--	7	--
Benzene	--	--	--	--	--	0.44	--
Chlorobenzene	--	--	320	--	--	64	--
cis-1,2-Dichloroethene (cis-DCE)	--	--	--	--	--	9.9	--
Ethylbenzene	--	--	--	--	--	7.3	7.3
Tetrachloroethene	--	--	--	--	--	0.24	--
Toluene	--	--	--	--	--	9.8	--
Trichloroethene (TCE)	--	--	--	--	--	0.06	--
Vinyl Chloride	--	--	--	--	--	0.022	--
Total Xylenes[4]	--	--	--	--	--	13	--
Polycyclic Aromatic Hydrocarbons (µg/kg)							
Acenaphthene	--	--	--	--	--	23	23
Anthracene	--	--	--	--	--	0.73	0.73
Benzo(a)anthracene	--	--	--	--	--	0.0012	0.0012
Benzo(a)pyrene	--	--	--	--	--	0.00012	0.00012
Benzo(b)fluoranthene	--	--	--	--	--	0.0012	0.0012
Benzo(k)Fluoranthene	--	--	--	--	--	0.0013	0.0013
Chrysene	--	--	--	--	--	0.0013	0.0013
Dibenz(a,h)anthracene	--	--	--	--	--	0.00012	0.00012
Indeno(1,2,3 c,d)pyrene	--	--	--	--	--	0.0012	0.0012
Naphthalene	--	--	140,000	--	140		12
cPAHs (BaP Eq)[3,5]	774	--	774,000	--	--	0.00012	0.00012
Total PAHs[3,6]	23,000	30,000	--	--	2,174	--	--
Semivolatile Organic Compounds (µg/kg)							
Bis(2-ethylhexyl)phthalate	135	--	--	--	595	--	0.2
Pentachlorophenol	--	--	--	--	--	0.03	0.03
PCBs (µg/kg)							
Total PCB[7]	9	75	200	--	612	0.014	0.0000064
Dioxin/Furans (ng/kg)							
2,3,7,8-TCDD	0.2	6	10	--	--	--	--
1,2,3,7,8-PeCDD	0.2	8	--	--	--	--	--
2,3,7,8-TCDF	0.40658	--	600	--	--	--	--
2,3,4,7,8-PeCDF	0.3	200	200	--	--	--	--
1,2,3,4,7,8-HxCDF	0.4	--	40	--	--	--	--

Table 1-1
Portland Harbor CULs, RALs, and PTW Thresholds

Parameter	Riverbank Soil/Sediment CUL[1]	Sediment				Groundwater CUL[1]	Surface Water CUL[1]
		Sitewide RALs[2]	PTW Thresholds[2]	Natural Background (DEQ, 2013)	Downtown Reach Background (LWG, 2016)		
Pesticides (µg/kg)							
2,4-Dichlorophenoxyacetic acid	--	--	--	--	--	70	--
Total DDD[8]	114	--	--	--	--	0.000031	0.000031
Total DDE[8]	226	--	--	--	--	0.000018	0.000018
Total DDT[8]	246	--	--	--	--	0.000022	0.000022
Total DDx[9]	6.1	160	7050	--	6.59	0.001	0.01
Aldrin	2	--	--	--	0.2624	--	0.00000077
Dieldrin	0.07	--	--	--	0.266	--	--
Hexachlorobenze	--	--	--	--	--	--	0.000029
Lindane	5	—	—	--	--	--	--
MCPP	--	--	--	--	--	--	16
Total Chlordanes[10]	1.4	—	—	--	1.29		0.000081
Petroleum Hydrocarbons (mg/kg)							
Diesel Range Organics	91	--	--	--	223	2.6	--
Organometallics (µg/kg)							
Tributyltin	3,080	--	--	--	74.61	--	0.063

Notes

[1] The riverbank soil/sediment, groundwater, and surface water cleanup levels are presented in Table 17 of the *Portland Harbor Superfund Site Record of Decision* (EPA, 2017) and updated in the cPAH Explanation of Significant Differences (ESD) (EPA, 2019).

[2] The Sediment RALs and PTW threshold values are presented in Table 21 of the Portland Harbor Superfund Site Record of Decision (EPA, 2017) and updated in the cPAH ESD (EPA, 2019).

[3] These values were presented in EPA's Explanation of Significant Differences (ESD). The cPAH value is the ESD PTW highly toxic threshold, and the total PAH value is the ESD sitewide RAL.

[4] Total xylene is the sum of *m*,p-xylene, *o*-xylene, and xylene.

[5] Total cPAH is the sum of benzo(a)pyrene equivalent concentrations. These equivalent concentrations are calculated by multiplying the cPAHs benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, and dibenzo(a,h)anthracene by their respective potency factors.

[6] Total PAH is the sum of 2-methylnaphthalene, acenapthene, acenaphthylene, anthracene, fluorene, naphthalene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzofluoranthenes, benzo(a)pyrene, indeno(1,2,3-c,d)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

[7] Total PCBs are the sum of PCB congeners. If no PCB congener data were available for a given sample, PCB Aroclors can be summed and screened against the total PCB screening levels.

[8] Total DDD, DDE, and DDT are the sums of their 2,4 and 4,4 isomers.

[9] Total DDx is defined in the ROD as the sum of all DDD, DDE, and DDT (EPA, 2017).

[10] Total chlordanes are the sum of cis-chlordane, trans-chlordane, oxychlordane, cis-nonachlor, and trans-nonachlor.

--: not applicable
µg/kg: micrograms per kilogram
BaP Eq: benzo(a)pyrene equivalent
cPAH: carcinogenic polycyclic aromatic hydrocarbon
CUL: cleanup Level
EPA: U.S. Environmental Protection Agency
mg/kg: milligrams per kilogram
PTW: principal threat waste
RAL: remedial action level
DDD: dichlorodiphenyldichloroethane
DDT: dichlorodiphenyldichloroethylene
DDE: dichlorodiphenyltrichloroethane

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Table 2-1
AOC Alignment

AOC Sufficiency Assessment Requirements			Report Section	Report Table	Report Figure
Items (a) and (b): The Sufficiency Assessment will consider potential impacts from a range of sources including but not limited to the following	(1) Upland pathways	Direct discharges	--	--	--
		Groundwater			
		Riverbank			
		Overwater			
	Miscellaneous pathways	(2) In-water sources of recontamination			
		(3) Resuspension of sediments from natural and anthropogenic activities			
		(4) Factors impacting cap effectiveness			
		(5) Potential future nearshore and in-water uses			
		(6) Future conditions (climate change impacts)			
Item (c): Components of the Sufficiency Assessment Report	(1) Description of the Project Area and Crawford Street Area	Setting	1.1, 4	--	1-1, 3-1, 4-1, 4-2, 4-3, 4-4, 4-5
		Upland source areas being evaluated	1.2, 4.3, 4.4, 5.1	--	4-1, 4-3, 5-1
		In-water source areas being evaluated	1.2, 4.5, 5.2	3-1, 3-2, 3-3	4-1, 4-4, 4-5, 5-2
		Report overview	2	--	--
	(2) Conceptual site model	Describe upland (direct discharge, groundwater, river bank, and overwater) sources of COCs and migration pathways into the project area	4.3, 4.4, 5.1	2-1	4-1, 4-3, 5-1
		Describe in-water sources of COCs and migration pathways into the project area	4.5, 5.2	--	4-1, 4-4, 4-5, 5-2
	(3) Summary of available information regarding the source control status of upland pathways (direct discharge, groundwater, river bank, and overwater)	Compare to ROD Table 17 CULs and Table 21 RALs and PTW thresholds	5.1	--	4-2
		Identify sources, COCs, and pathways that have not been effectively addressed and could impact the RA	5.1, 7.1	7-1	--
		Identify data gaps	5.1, 7.4, 8.1	7-2	--
	(4) Summary of in-water sources of COCs to the Project Area	Compare to ROD Table 17 CULs and Table 21 RALs and PTW thresholds	3, 5.2	3-1, 3-2, 3-3	3-1
		Describe proposed measures for addressing in-water sources, including timing and expected effectiveness	5.2, 6.1.2, 8.2	--	--
	(5) Assessment of the degree to which the proposed remedy will address upland and in-water sources of COCs		5	--	--
	(6) Assessment of the degree to which changed future conditions may affect recontamination potentail at the Project Area	Land use changes	6.2	--	--
		Waterway use changes	6.3	--	--
		Climate change	6.4	--	--
	(7) Results of the Sufficiency Assessment	Evaluation of upland source controls' ability to reduce the potential for recontamination	5.1, 7.1, 7.2	7-1	--
		Evaluation of in-water source controls' ability to reduce the potential for recontamination	5.2, 7.1, 7.2	7-1	--
		General magnitude of any potential recontamination effects	5.1, 5.2, 6.5, 7.2	7-1	--
		Implications to the selected remedy	5.1, 5.2, 6.5, 7.2	--	--
		Limitations of the sufficiency assessment	7.3	--	--
		Remaining data gaps	5.1, 5.2, 7.4, 8.1	7-2	--
	(8) Sufficiency summary table of upland sources	Explicitly identifies the potential sources and pathways at the Project Area and Crawford Street Area (see outcome categories in the AOC)	7.1	7-1	--
	(9) Description of how data gaps will be addressed		8.1	7-2	--
	(10) Conclusions and recommendations. Recommendations will be expressed as one of three potential outcomes (see the AOC Statement of Work for language)		7.1, 8	7-1	--
	(11) References cited		9	--	--
Item (d): The Sufficiency Assessment itself does not satisfy the requirements of the Clean Water Act, Comprehensive Environmental Response, Compensation, and Liability Act of 1980, or other authorities. Following remedy implementation, post construction monitoring will be performed to evaluate remedy effectiveness. Postconstruction monitoring will be designed to distinguish between recontamination and assessing whether the remedy is functioning as intended to achieve its long-term performance goals across temporal and spatial scales.					

Notes

AOC: Administrative Settlement Agreement and Order on Consent
COC: contaminant of concern
CUL: cleanup level
PTW: principal threat waste
RAL: remedial action level
ROD: Portland Harbor Superfund Site Record of Decision

Table 3-1
Step 1 Table 21 COC Screening Process

Portland Harbor COC[1]	Portland Harbor Criteria[1]			Point-by-Point Screening against Screening Value[2]					Carry Forward as Specific COC?
	Sitewide RAL	PTW Threshold	Units	Number of Reported Results	Number of Detected Results	Number of Detected RAL Exceedances	Number of Detected PTW Exceedances	Frequency of Detected CUL Exceedances (%)	
Persistent									
Total PCBs[3,4]	75	200	µg/kg	70	70	18	8	68.6	Yes
1,2,3,4,7,8 hexachlorodibenzofuran (HxCDF)	--	0.04	µg/kg	33	30	NA	3	81.8	Yes
1,2,3,7,8 pentachlorodibenzo p dioxin (PeCDD)	0.0008	0.1	µg/kg	33	23	11	1	48.5	Yes
2,3,4,7,8 pentachlorodibenzofuran (PeCDF)	0.2	0.2	µg/kg	33	26	1	1	57.6	Yes
2,3,7,8 tetrachlorodibenzo p dioxin (TCDD)	0.0006	0.1	µg/kg	33	23	10	0	39.4	Yes
2,3,7,8 tetrachlorodibenzofuran (TCDF)	--	0.6	µg/kg	33	30	NA	1	63.6	Yes
Hydrocarbons									
Total cPAHs (BaP Eq)[4]	--	774,000	µg/kg	84	84	NA	0	44.0	No
Total PAHs[4]	30,000	--	µg/kg	91	91	5	NA	5.5	Yes
TPH Diesel (Diesel Range Hydrocarbons)	--	--	mg/kg	37	32	NA	NA	24.3	No
Napthalene		140	µg/kg	85	69	NA	0	NA	No
Volatiles									
Chlorobenzene		320	µg/kg	3	0	NA	0	NA	No
Pesticides									
Total DDx[4]	160	7050	µg/kg	64	64	2	0	46.9	Yes

Notes

Orange highlighting indicates that the Portland Harbor sitewide RAL or PTW threshold was exceeded by at least one surface sediment sample collected within the Project Area.

Conclusion: 8 of the 10 focused COCs and additional contaminants identified in Table 21 of the Portland Harbor Record of Decision were retained as Project Area site-specific COCs due to detected exceedances of RALs and/or PTW thresholds.

[1] COCs and CULs were derived from Table 17, and sitewide RALs and PTW thresholds were dervied from Table 21 of the Portland Harbor Record of Decision and updated per the 2019 Explanation of Significant Differences for PAHs (EPA, 2019).

[2] Screening was done against surface sediment data collected from within the Willamette Cove Project Area and includes data collected through the Pre-RD PDI Data Report. Data reflects the remedial design guidance data rules, which includes nondetected analytes at half the detection limit in analyte group totals. Where no analytes in a given group were detected, the highest individual detection limit was used as the total. For individual analytes (e.g., arsenic), the screening was performed using one-half of the detection limit.

[3] Total PCB screening was conducted first for PCB congeners. If no PCB congener data was available for a given sample, total PCB Aroclors were screened against the total PCB screening levels.

[4] Total concentrations were summed using one-half the method detection limit for samples with nondetects.

µg/kg: micrograms per kilogram
BaP Eq: benzo(a)pyrene equivalent
COC: contaminant of concern
cPAHs: carcinogenic polycyclic aromatic hydrocarbons
CUL: cleanup Level
DDD: dichlorodiphenyldichloroethane
DDE: dichlorodiphenyltrichloroethane
DDT: dichlorodiphenyldichloroethylene
DDx: The sum of 2,4' and 4,4' - DDD, DDE, and DDT
mg/kg: milligrams per kilogram
NA: not applicable
PAHs: polycyclic aromatic hydrocarbons
PCBs: polychlorinated biphenyls
PTW: principal threat waste
RAL: remedial action level
TPH: total petroleum hydrocarbon

EPA. 2019. Explanation of Significant Differences Portland Harbor Superfund Site Portland, Oregon. U.S. Environmental Protection Agency, Region 10. December 9, 2019.

Table 3-2
Step 2 Site-Specific COC Screening Process

Portland Harbor COC	Portland Harbor CUL		DEQ Natural Background Concentration	Units	Point-by-Point Screening Against Natural Background and CULs[1]				Step 2a - Detected Frequency of Natural Background or CUL Exceedance ≥ 10%		Carry Forward as Site-Specific COC?
	Basis	Value			Number Reported Results	Number of Detected CUL Exceedances	Number of ND CUL Exceedances	Number of Detected Natural Background Exceedances	Frequency of Detected CUL Exceedance (%)	Frequency of ND CUL Exceedance (%)	
Persistent											
Total PCBs[2]	Background	9	--	µg/kg	70	48	0	--	68.6	--	Yes
Dioxin/Furan TEQ (2,3,7,8-TCDD Eq)[3]	RAO 1 Sediment	0.01	--	ug/kg				--			Yes
1,2,3,4,7,8 hexachlorodibenzofuran (HxCDF)	Background	0.0004	--	µg/kg	33	27	3	--	81.8	100.0	Yes
1,2,3,7,8 pentachlorodibenzo p dioxin (PeCDD)	Background	0.0002	--	µg/kg	33	16	4	--	48.5	40.0	Yes
2,3,4,7,8 pentachlorodibenzofuran (PeCDF)	Background	0.0003	--	µg/kg	33	19	2	--	57.6	28.6	Yes
2,3,7,8 tetrachlorodibenzo p dioxin (TCDD)	Background	0.0002	--	µg/kg	33	13	1	--	39.4	10.0	Yes
2,3,7,8 tetrachlorodibenzofuran (TCDF)	RAO 2 Sediment	0.0004	--	µg/kg	33	21	1	--	63.6	25.0	Yes
Hydrocarbons											
Total cPAHs (BaP Eq)[3]	Background	774	--	µg/kg	84	37	0	--	44.0	0.0	Yes
Total PAHs[3]	RAO 5 Sediment	23,000	--	µg/kg	91	5	0	--	5.5	0.0	Yes[4]
TPH Diesel (Diesel Range Hydrocarbons)	RAO 5 Sediment	91	--	mg/kg	37	9	1	--	24.3	1.0	Yes
Pesticides											
Aldrin	RAO 2 Sediment	2	--	µg/kg	50	0	0	--	0.0	0.0	No
Dieldrin	RAO 2 Sediment	0.07	--	µg/kg	50	0	37	--	0.0	84.1	Yes
Total DDD[3]	RAO 5 Sediment	114	--	µg/kg	64	0	0	--	0.0	0.0	No
Total DDE[3]	RAO 6 Sediment	226	--	µg/kg	63	0	0	--	0.0	0.0	No
Total DDT[3]	RAO 5 Sediment	246	--	µg/kg	62	0	0	--	0.0	0.0	No
Total DDx[3]	RAO 2 Sediment	6.1	--	µg/kg	64	30	0	--	46.9		Yes
gamma-HCH (Lindane)	RAO 5 Sediment	5	--	µg/kg	50	2	0	--	4.0	0.0	No
Total Chlordane[3]	RAO 5 Sediment	1.4	--	µg/kg	50	9	8	--	18.0	34.8	Yes
Metals											
Arsenic	Background	3	8.8	mg/kg	60	43	0	1	71.7	0.0	Yes
Cadmium	RAO 5 Sediment	0.51	0.63	mg/kg	56	3	0	2	5.4	0.0	No
Copper	RAO 5 Sediment	359	34	mg/kg	56	1	0	--	1.8	--	No
Lead	RAO 5 Sediment	196	79	mg/kg	56	1	0	--	1.8	--	No
Mercury	RAO 5 Sediment	0.085	0.23	mg/kg	55	40	0	19	72.7	0.0	Yes
Zinc	RAO 5 Sediment	459	180	mg/kg	56	1	0	--	1.8	--	No
Butyltin											
Tributyltin	RAO 5 Sediment	3.08	--	mg/kg	19	0	0	--	0.0	0.0	No
Phthalates											
BEHP	RAO 6 Sediment	135	--	µg/kg	56	24	3	--	8.9	9.4	No

Notes

Orange highligting indicates that the sediment CUL was exceeded by at least 10% of the surface sediment samples with detections of that COC collected within the Project Area.

Conclusion: 13 of 6 COCs with sediment CULs in Table 17 of the Portland Harbor Record of Decision were retained as Project Area site-specific COCs due to CUL exceedances in ≥ 10% of samples with detections.

Table 3-2
Step 2 Site-Specific COC Screening Process

[1] Screening was done against "surface sediment" data located within the Willamette Cove Project Area. Data reflects the FS data rules, which includes nondetected analytes at one-half the detection limit in analyte group totals. Where no analytes in a given group were detected, the highest individual detection limit was used as the total. For individual analytes (e.g., arsenic), the screening was performed using one-half of the detection limit.

[2] Total PCB screening was conducted first for PCB congeners. If no PCB congener data was available for a given sample, total PCB Aroclors were screened against the total PCB screening levels.

[3] Total concentrations were summed using one-half the method detection limit for samples with nondetects.

[4] Total PAHs are an SSCOC based on the RAL exceedances detailed in Table 3-1.

--: not applicable
µg/kg: micrograms per kilogram
BaP Eq: benzo(a)pyrene equivalent
BEHP: bis(2-ethylhexyl)phthalate
COC: contaminant of concern
CUL: cleanup level
DDD: dichlorodiphenyldichloroethylene
DDE: dichlorodiphenyldichloroethylene
DDT: dichlorodiphenyltrichloroethane
DDx: The sum of 2,4' and 4,4' - DDD, DDE, and DDT
DEQ: Oregon Department of Environmental Quality
mg/kg: milligrams per kilogram
PAHs: polycyclic aromatic hydrocarbons
PCBs: polychlorinated biphenyls
RAO: remedial action objective

Table 3-3
Site-Specific COCs

Site-Specific Contaminant of Concern	Portland Harbor Criteria			
	CUL	Sitewide RAL	PTW Threshold	Units
Persistent				
Total PCBs[1]	9	75	200	µg/kg
Dioxin/furan TEQ (2,3,7,8-TCDD Eq)	0.01	--	--	
1,2,3,4,7,8 hexachlorodibenzofuran (HxCDF)	0.0004	--	0.04	
1,2,3,7,8 pentachlorodibenzo p dioxin (PeCDD)	0.0002	0.0008	0.01	
2,3,4,7,8 pentachlorodibenzofuran (PeCDF)	0.0003	0.2	0.2	
2,3,7,8 tetrachlorodibenzo p dioxin (TCDD)	0.0002	0.0006	0.01	
2,3,7,8 tetrachlorodibenzofuran (TCDF)	0.0004	--	0.6	
Hydrocarbons				
Total cPAHs (BaP Eq)	774	--	774,000	µg/kg
Total PAHs	23,000	30,000	--	
TPH Diesel (Diesel Range Hydrocarbons)	91	--	--	mg/kg
Pesticides				
Dieldrin	0.07	--	--	µg/kg
Total DDx[1]	6.1	160	7050	
Total Chlordane[1]	1.4	--	--	
Metals				
Arsenic	3	--	--	mg/kg
Mercury	0.085	--	--	mg/kg

Notes

[1] Total concentrations calculated by using one-half the detection limit for nondetect analytes.

'--: not applicable

µg/kg: micrograms per kilogram

BaP Eq: benzo(a)pyrene equivalent

cPAHs: carcinogenic polycyclic aromatic hydrocarbons

CUL: cleanup Level

DDx: The sum of DDD, DDE, and DDT

mg/kg: milligrams per kilogram

PAHs: polycyclic aromatic hydrocarbons

PCBs: polychlorinated biphenyls

PTW: principal threat waste

RAL: remedial action level

TPH: total petroleum hydrocarbon

Table 7-1
Sufficiency Assessment Summary

Pathways	Site	ECSI ID Number	Status	Site-Specific and Media-Specific COCs	Milestone Document	Remedial Design/Source Control Task
Upland Area Pathways			A			
Direct Discharge	Municipal (OF-49)	NA	A	Metals, PAHs, and Total PCBs	DEQ, 2016	Ensure SCMs remain in place; the outfall is operated in compliance with permits
	WC Upland Facility	2066	A	Unknown	Apex, 2019	Incomplete pathway, but overland flow was not assessed. The WC Upland Facility riverbank will be incorporated into RD.
	Crawford Street Area	2363	C(a)	Unknown	DEQ, 2016	Implement SCMs to address overland flow and direct discharges
Groundwater	WC Upland Facility	2066	C(u)	Metals, PAHs, Total DDD, Total PCBs, Pentachlorophenol, and VOCs	Apex, 2020	Sampling to characterize porewater conditions. Assess data, SCM, and capping needs during RD
	Crawford Street Area	2363	C(a)	Unknown	DEQ, 2016	Sampling to characterize porewater conditions. Assess data, SCM, and capping needs during RD
Riverbank Erosion	WC Upland Facility	2066	B	Metals, TPH-Diesel, Total PAHs and cPAHs, Total PCBs, and Dioxin/Furans	Apex, 2019	A comprehensive sampling program and incorporation of the riverbank into RD
	Crawford Street Area	2363	C(u)	Metals, Total DDx, TPH-Diesel, Total PAHs and cPAHs, Total PCBs, and Dioxin/Furans	Cascadia, 2020	SCM
In-water Pathways						
Upriver SPM	McCormick & Baxter	74	B	Total DDx, Total PCBs, TPH-Diesel	DEQ, 2016	Ongoing monitoring to ensure no adverse impacts to the RA from upriver SPM occur
Project Area Sediment Resuspension	NA	NA	A	SSCOCs (Section 3)	NA	Incomplete pathway
Groundwater Advection (Porewater)	NA	NA	C(a)	Metals (other analytes unknown)	NA	A comprehensive sampling program and incorporation of advected groundwater into RD
Existing Structures	BNSF Railroad Bridge	NA	C(a)	Metals, Total PAHs and cPAHs, and Total PCBs	NA	Incorporation into RD and establishment of ICs
Overwater Activities	NA	NA	A	—	NA	--
Surrounding Poperties						
McCormick & Baxter Superfund Site	NA	74	C(a)	PAHs, dioxin/furans, PCP, metals	EPA, 1996	EPA and DEQ are conducting performance monitoring of the remedy in 2020. Data will be evaluated as part of RD to assess potential impacts to RA.
BNSF Railraod Bridge	NA	NA	C(a)	Unknown	NA	No information available. Future assessment of this facility would be conducted under DEQ Source Control Program.

Notes
All milestone documents are available on DEQ's ECSI website.
A: Sources are sufficiently controlled.
B: Sources are conditionally controlled.
C(a): Sources are not sufficiently assessed.
C(u): Sources are not sufficiently controlled.

COC: contaminant of concern
cPAHs: carcinogenic polycyclic aromatic hydrocarbons
DDD: dichlorodiphenyldichloroethylene
DDD: dichlorodiphenyldichloroethylene
DDE: dichlorodiphenyldichloroethylene
DDT: dichlorodiphenyltrichloroethane
DDx: The sum of 2,4' and 4,4' - DDD, DDE, and DDT
DDx: The sum of DDD, DDE, and DDT
DEQ: Oregon Department of Environmental Quality
ECSI: Environmental Cleanup Site Information Database
IC: institutional control

Apex. 2019. Revised Feasibility Study and Source Control Evaluation, Willamette Cove Upland Facility, Portland, Oregon. Prepared for the Port of Portland. March 7, 2019.
Apex. 2020. Revised Groundwater Source Control Evaluation and Alternatives Analysis Willamette Cove Upland Facility, Portland, Oregon. Prepared for the Port of Portland. January 20, 2020.
Cascadia Associates. 2020. Leave Surface Characterization Report Crawford Street Site, Portland, Oregon. Prepared for Schnitzer Steel Industries. January 30, 2020.
DEQ. 2016. Portland Harbor Upland Source Control Summary Report. Oregon Department of Environmental Quality. March 25, 2016.

Table 7-2
Summary of Data Gaps

Data Gap	Pathway	Information Required	Responsible Program
Groundwater Characterization in Uplands	Groundwater	Additional chemical and phyisical data	Upland Source Control under DEQ Oversight
Data to support integration of the riverbank within Project Area into RD	Riverbank Erosion	Additional chemical and phyisical data	WC RD
Data to support integration of riverbank at Crawford Street into RD	Riverbank Erosion	Design information and soil chemical data	Upland Source Control under DEQ Oversight
Suspended Particulate Matter (SPM)	Upriver SPM	Sediment Trap data	WC RD
Groundwater Advection	Groundwater	Porewater data	WC RD
Evaluation of BNSF Railroad Bridge as potential source	Existing Structures	Unknown	Upland Source Control under DEQ oversight
McCormick and Baxter (M&B)	Groundwater and SPM	Porewater data, sediment data, sediment trap, perfromance monitoring data from M&B.	WC RD, EPA/DEQ performance monitoring at M&B
Dioxin/furan groundwater data in East Parcel	Groundwater	Additional groundwater chemistry	Upland Source Control under DEQ oversight
Climate Change Resiliency	Riverbank Erosion	Effects of climate change and sea level rise on river hydrodynamics (stage and velocity) in Project Area	WC RD

Notes

WC RD : Willamette Cove Remedial Design

BNSF: BNSF Railway

FIGURES

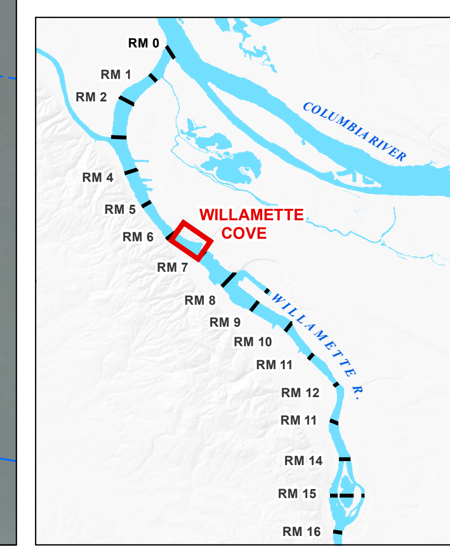
FIGURE 1-1

Project Area Overview

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- Toe of Bank, -2 ft (CRD)[2]
- USACE Navigation Channel
- River Mile (RM)



NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].
2. Toe-of-bank contour generated from 2020 site bathymetry, Solmar Hydro.

0 175 350
Feet

Date: April 9, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014,
Imagery COP Summer 2018

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Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure1-1_WC_Project_Area.mxd

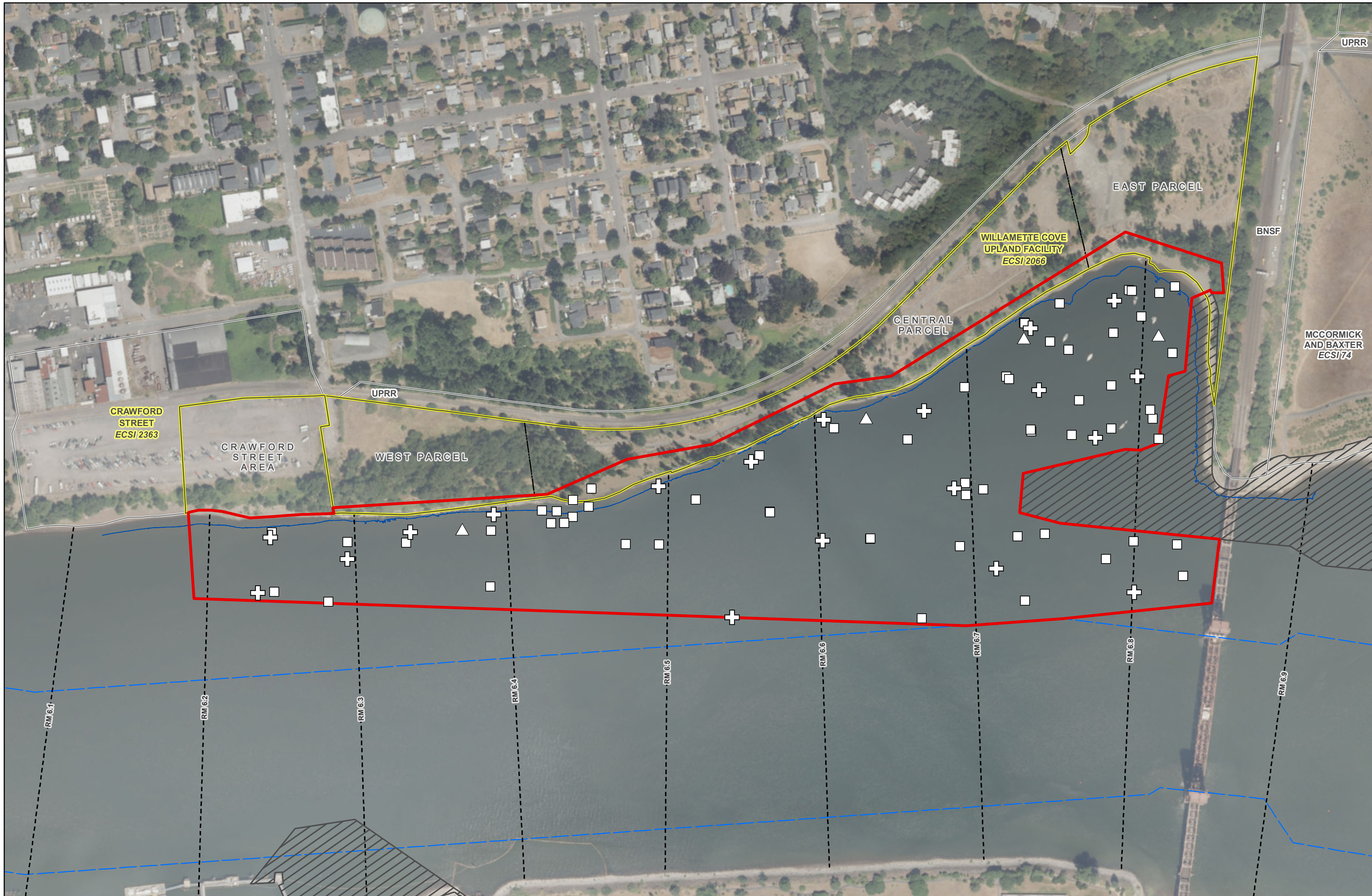

FIGURE 3-1

Historical Surface Sediment Sampling Locations within the Project Area

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

Surface Sediment Sample

- Pre-Remedial Design Investigation (PDI) Station, 2018
- EPA Remedial Investigation/Feasibility Study, 2016
- Weston, 1998

All Other Features

- Willamette Cove Project Area
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped
- Toe of Bank, -2 ft (CRD)[2]
- USACE Navigation Channel
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].
2. Toe-of-bank contour generated from 2020 site bathymetry, Solmar Hydro.

Date: June 24, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

0 175 350
Feet

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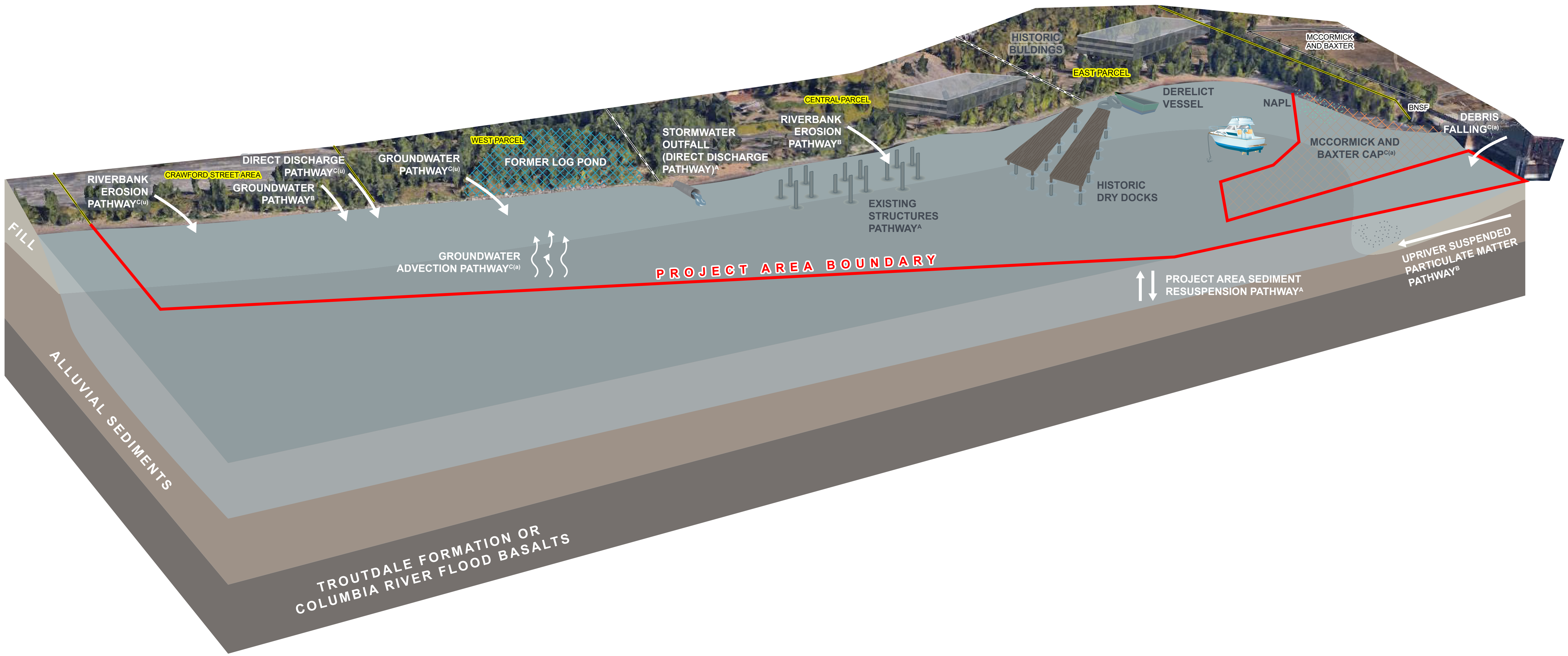
Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure3-1_Surface_Sample_Locs.mxd



NOTES

A Source is sufficiently controlled
B Source is conditionally controlled
C(a) Source is not sufficiently assessed
C(u) Source is not sufficiently controlled

GSI Water Solutions, Inc.

FIGURE 4-1

Conceptual Site Model

Sufficiency Assessment
Willamette Cove
Portland, Oregon

Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment

FIGURE 4-2

Combined Surface Sediment RAL and PTW Threshold Exceedances

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Extents of RAL/PTW Exceedance, Dashed Where Inferred[1,2]
- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[3]
- Adjacent Parcel
- Capped Area
- Toe of Bank, -2 ft (CRD)[4]
- USACE Navigation Channel
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The extent of surface sediment RAL and PTW threshold exceedances was created consistent with the processes used in the Portland Harbor Feasibility Study (EPA, 2016a) and included data collected by the Pre-Remedial Design Group after the Portland Harbor ROD was issued (AECOM and Geosyntec, 2019).
2. Non-detect results above RAL/PTW were excluded from interpolation.
3. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].
4. Toe-of-bank contour generated from 2020 site bathymetry, Solmar Hydro.

Date: April 9, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014,
Imagery COP Summer 2018

N

0 175 350
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-2_RAL_PTW_Exceedance.mxd

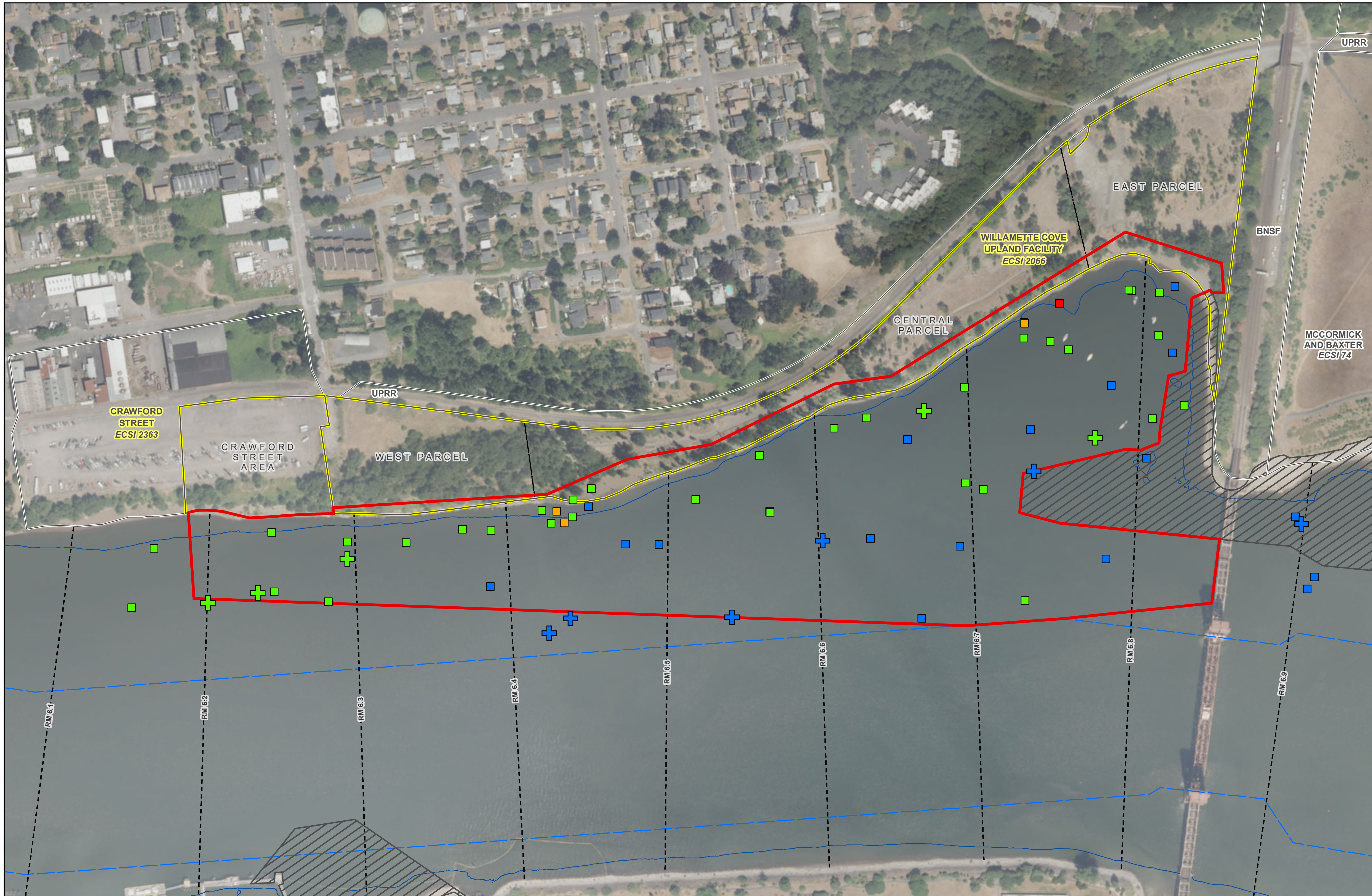


FIGURE 4-3

Mercury
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

Pre-RD Sample Location
Historic Sample Location

Mercury Concentration (mg/kg)

>8.5
>0.85-8.5
>0.085-0.85
<0.085

All Other Features

Willamette Cove Project Area Boundary
Upland Parcel
Upland Subparcel[1]
Adjacent Parcel
Capped Area
USACE Navigation Channel
-2 ft (CRD)
River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Mercury Criteria
Sediment Cleanup Level (CUL): 0.085 mg/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: Not Applicable

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N

0 175 350
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-3_Mercury.mxd

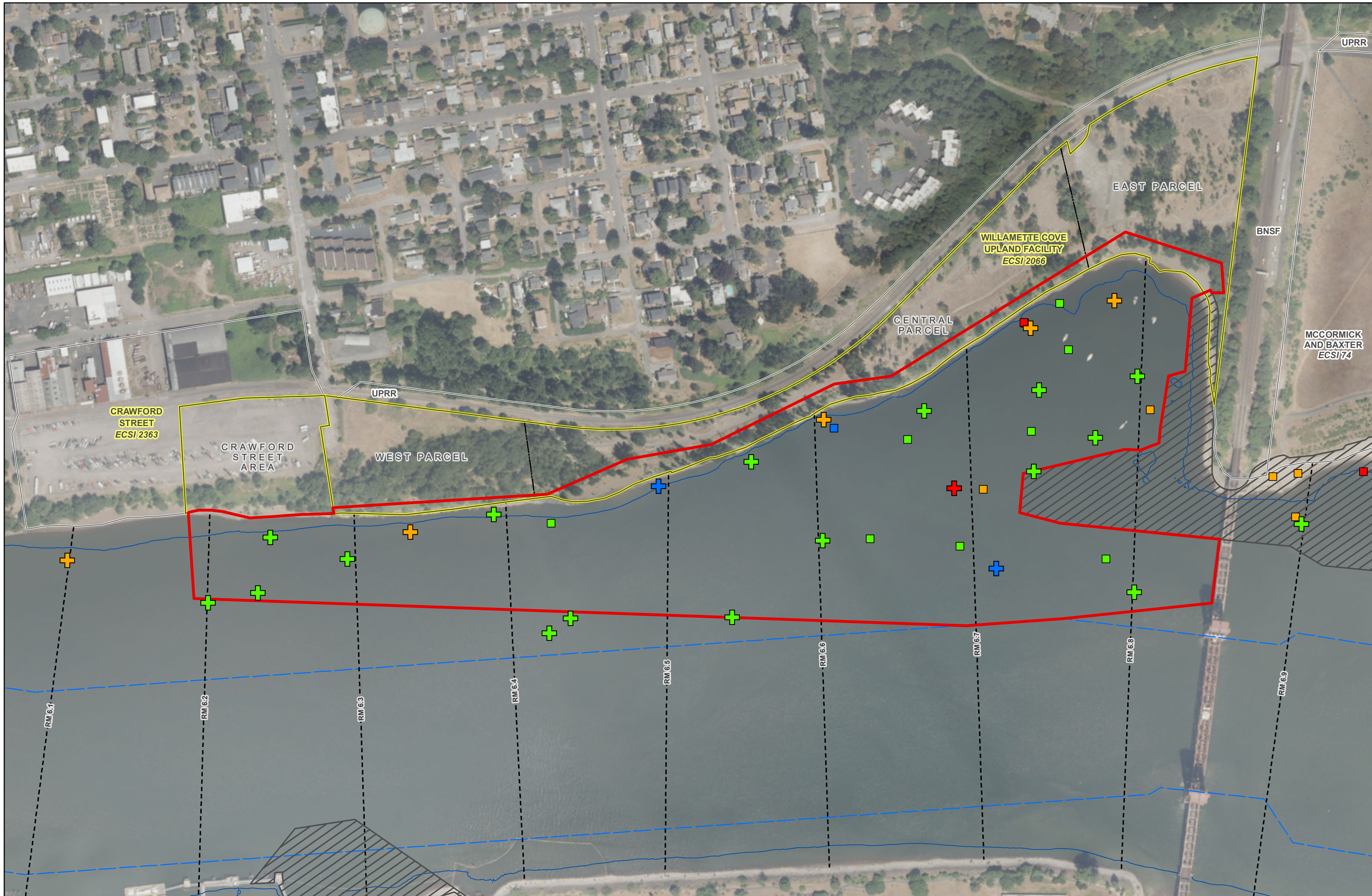


FIGURE 4-4

HxCDF Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

Pre-RD Sample Location
Historic Sample Location

HxCDF Concentration (ug/kg)

>0.04
>0.004-0.04
>0.0004-0.004
<0.0004

All Other Features

Willamette Cove Project Area Boundary
Upland Parcel
Upland Subparcel[1]
Adjacent Parcel
Capped Area
USACE Navigation Channel
-2 ft (CRD)
River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

HxCDF Criteria

Sediment Cleanup Level (CUL): 0.0004 ug/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: 0.04 ug/kg

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

0 175 350
Feet

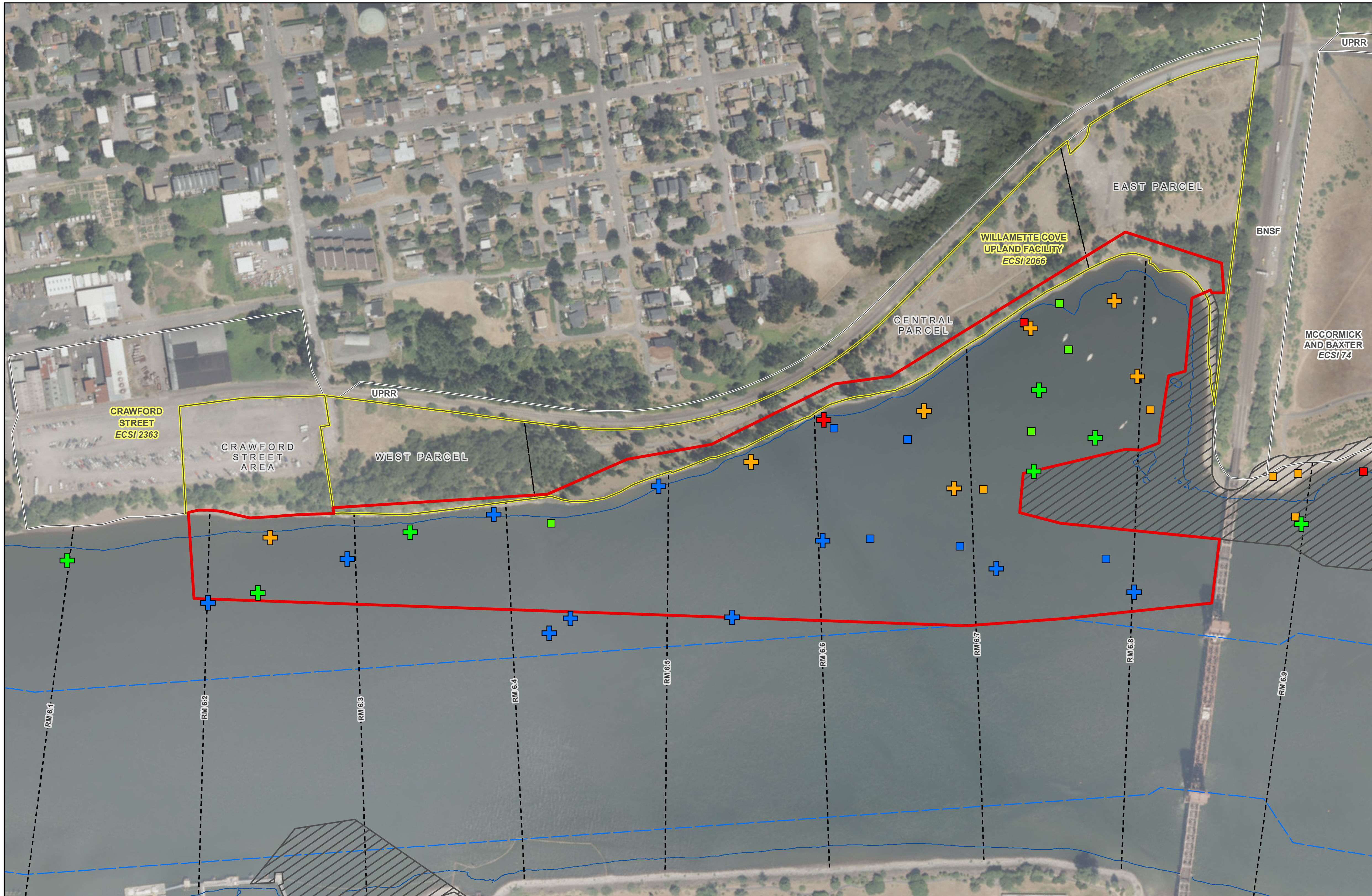
GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-4_HxCDF.mxd

FIGURE 4-5

PeCDD
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon



LEGEND

- Pre-RD Sample Location
- Historic Sample Location

PeCDD Concentration (ug/kg)

- >0.01
- >0.0008-0.01
- >0.0002-0.0008
- <0.0002

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

PeCDD Criteria
Sediment Cleanup Level (CUL): 0.0002 ug/kg
Sitewide Remedial Action Level (RAL): 0.0008 ug/kg
Principal Threat Waste (PTW) Threshold: 0.01 ug/kg

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

N

0 175 350
Feet

Date: June 11, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

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Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-5_PeCDD.mxd

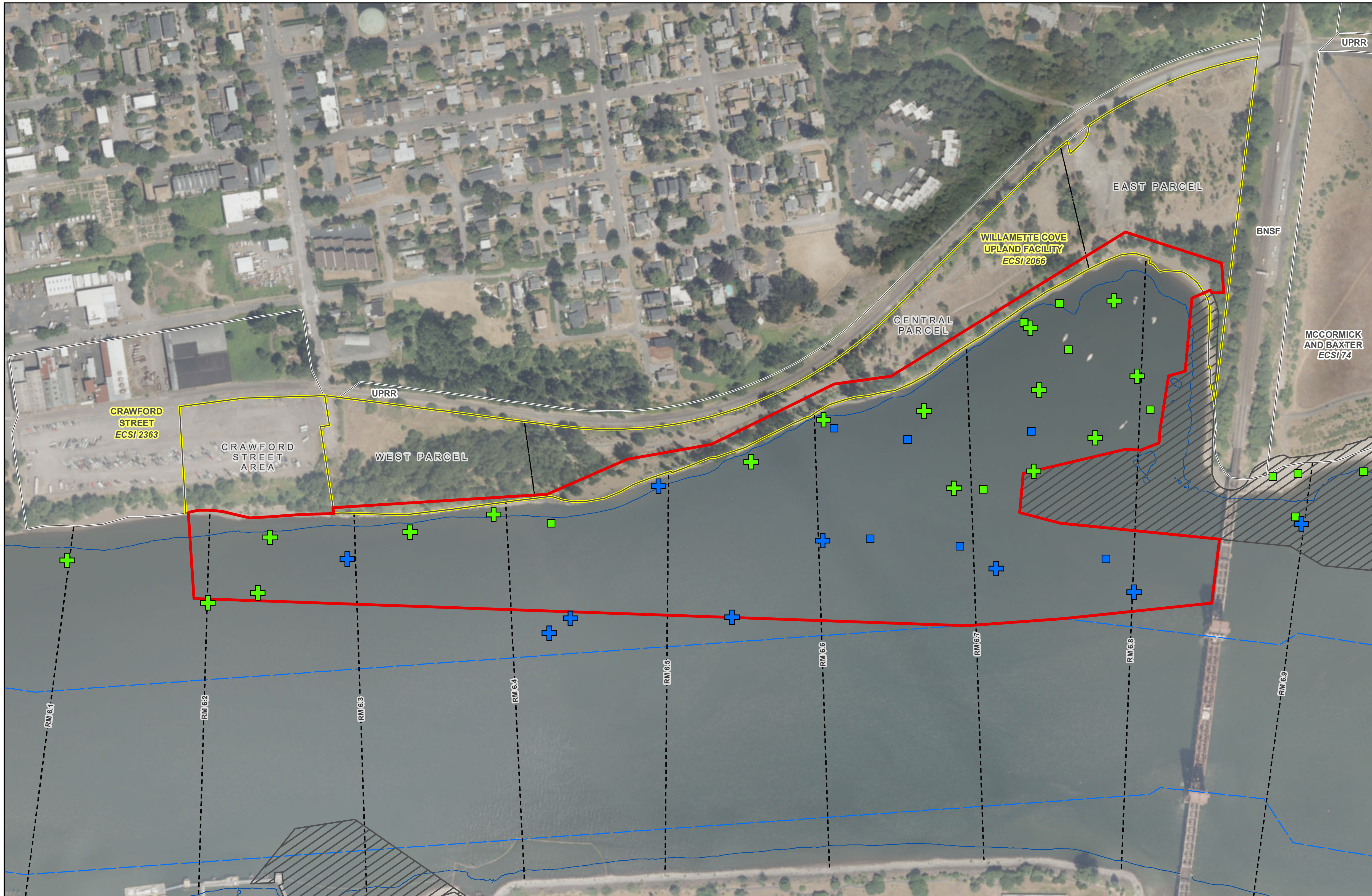


FIGURE 4-6

PeCDF Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

PeCDF Concentration (ug/kg)

- >0.2
- >0.0003-0.2
- <0.0003

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

PeCDF Criteria

Sediment Cleanup Level (CUL): 0.0003 ug/kg
Sitewide Remedial Action Level (RAL): 0.2 ug/kg
Principal Threat Waste (PTW) Threshold: 0.2 ug/kg

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

N

0 175 350
Feet

Date: June 11, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-6_PeCDF.mxd

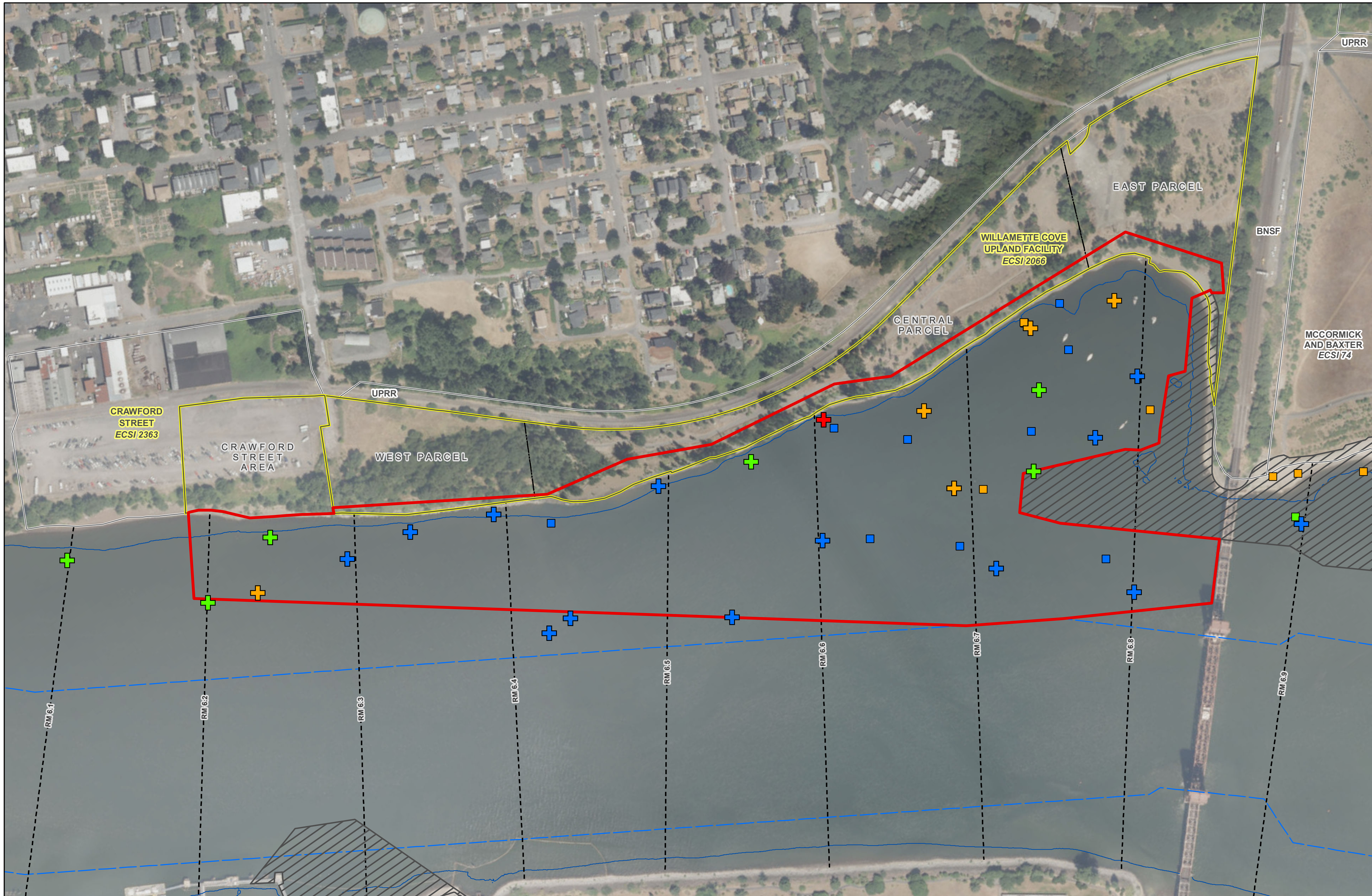


FIGURE 4-7

TCDD
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

TCDD Concentration (ug/kg)

- >0.01
- >0.0006-0.01
- >0.0002-0.0006
- <0.0002

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

TCDD Criteria
Sediment Cleanup Level (CUL): 0.0002 ug/kg
Sitewide Remedial Action Level (RAL): 0.0006 ug/kg
Principal Threat Waste (PTW) Threshold: 0.01 ug/kg

Date: June 11, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N
0 175 350
Feet

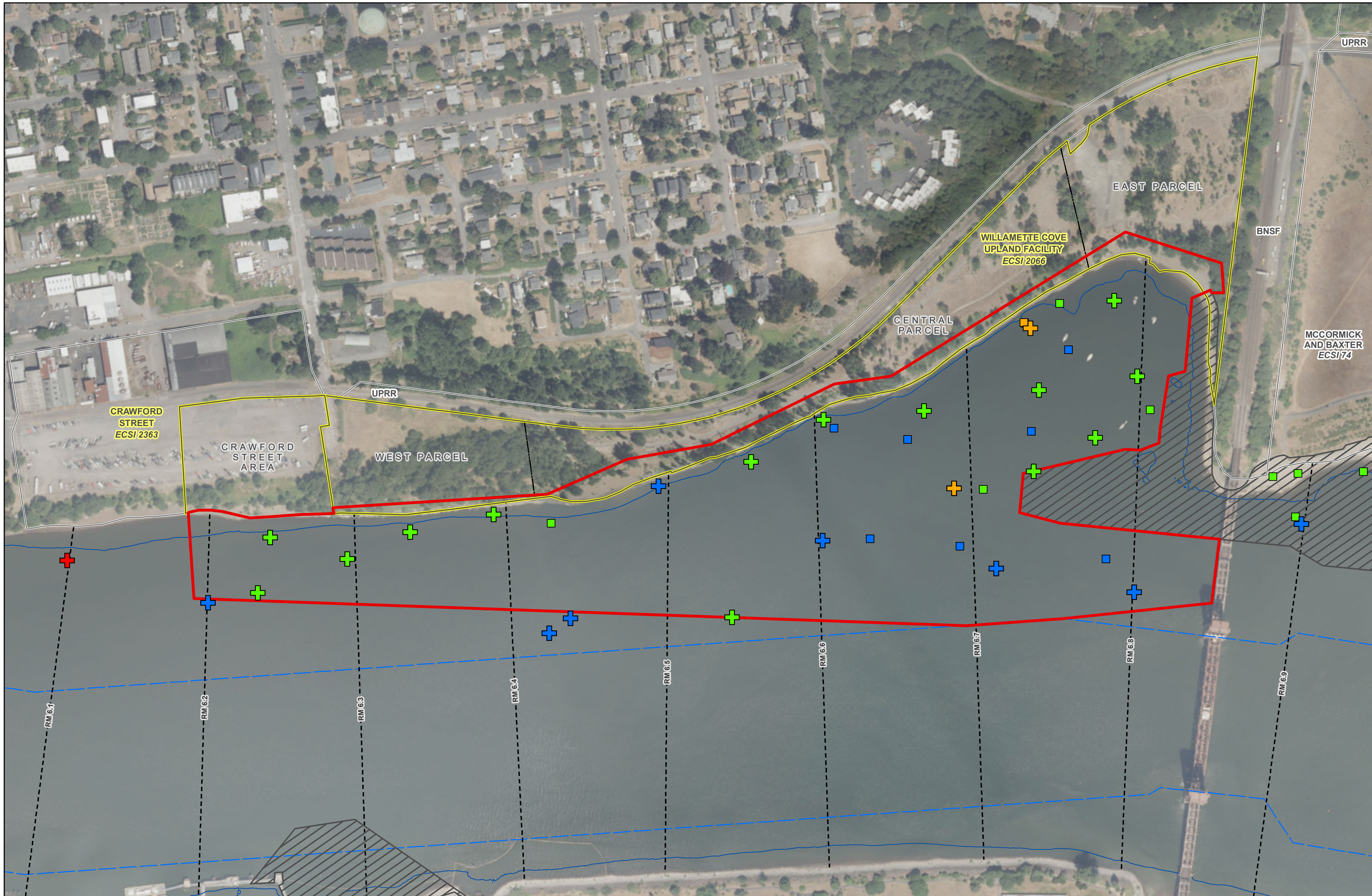
GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-7_TCDD.mxd

FIGURE 4-8

TCDF
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon



LEGEND

- Pre-RD Sample Location
- Historic Sample Location

TCDF Concentration (ug/kg)

- >0.06
- >0.006-0.06
- >0.00040658 -0.006
- <0.00040658

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

TCDF Criteria
Sediment Cleanup Level (CUL): 0.00040658 ug/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: 0.06 ug/kg

N
0 175 350
Feet

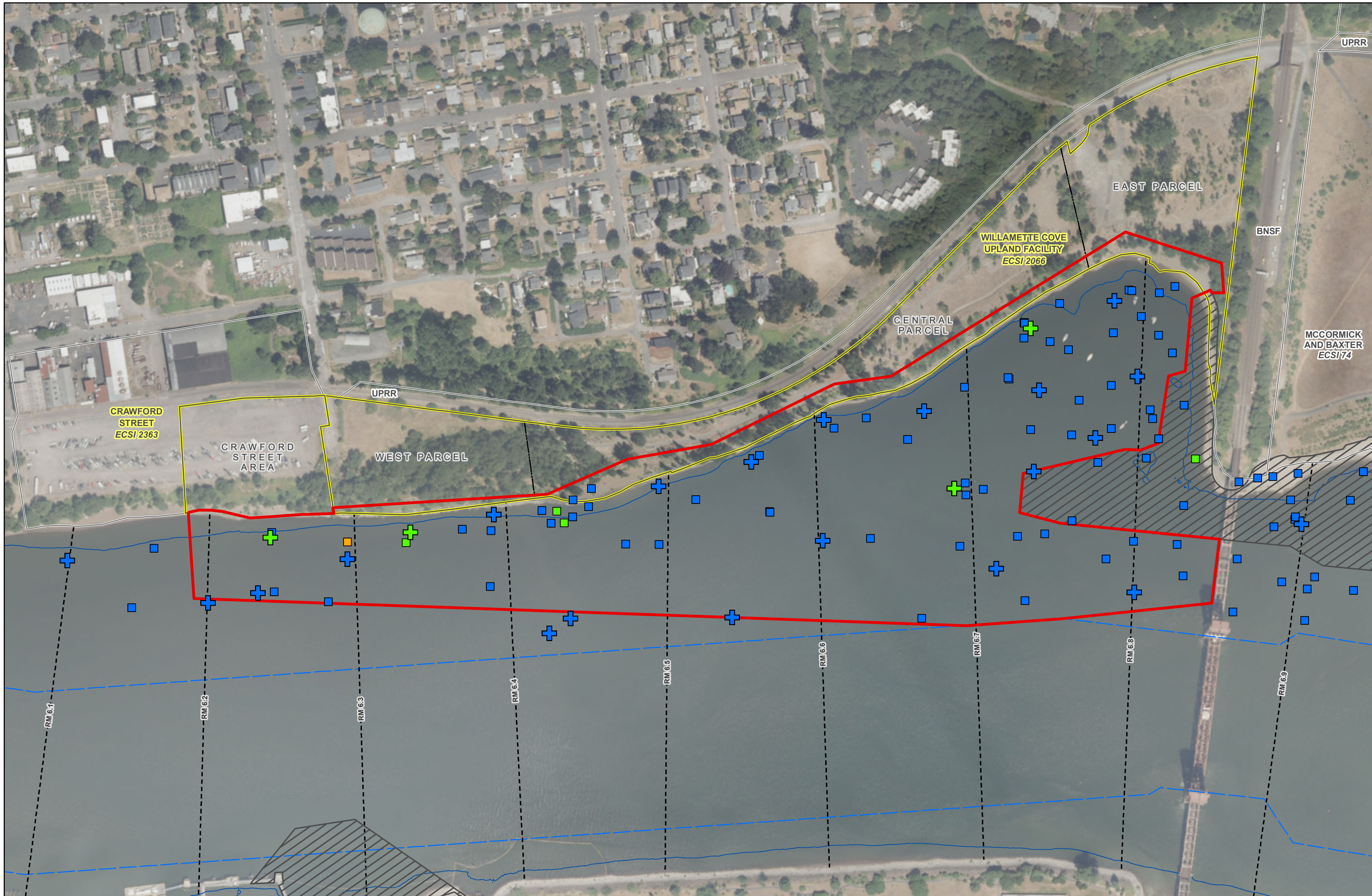
Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014,
Imagery COP Summer 2018

GSI Water Solutions, Inc.

FIGURE 4-9

cPAHs
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon



LEGEND

- Pre-RD Sample Location
- Historic Sample Location

cPAHs Concentration (ug/kg)

- >774,000
- >7,740-774,000
- >774-7,740
- <774

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

cPAHs Criteria
Sediment Cleanup Level (CUL): 774 ug/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: 774,000 ug/kg

N
0 175 350
Feet

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

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Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-9_CPAHs.mxd

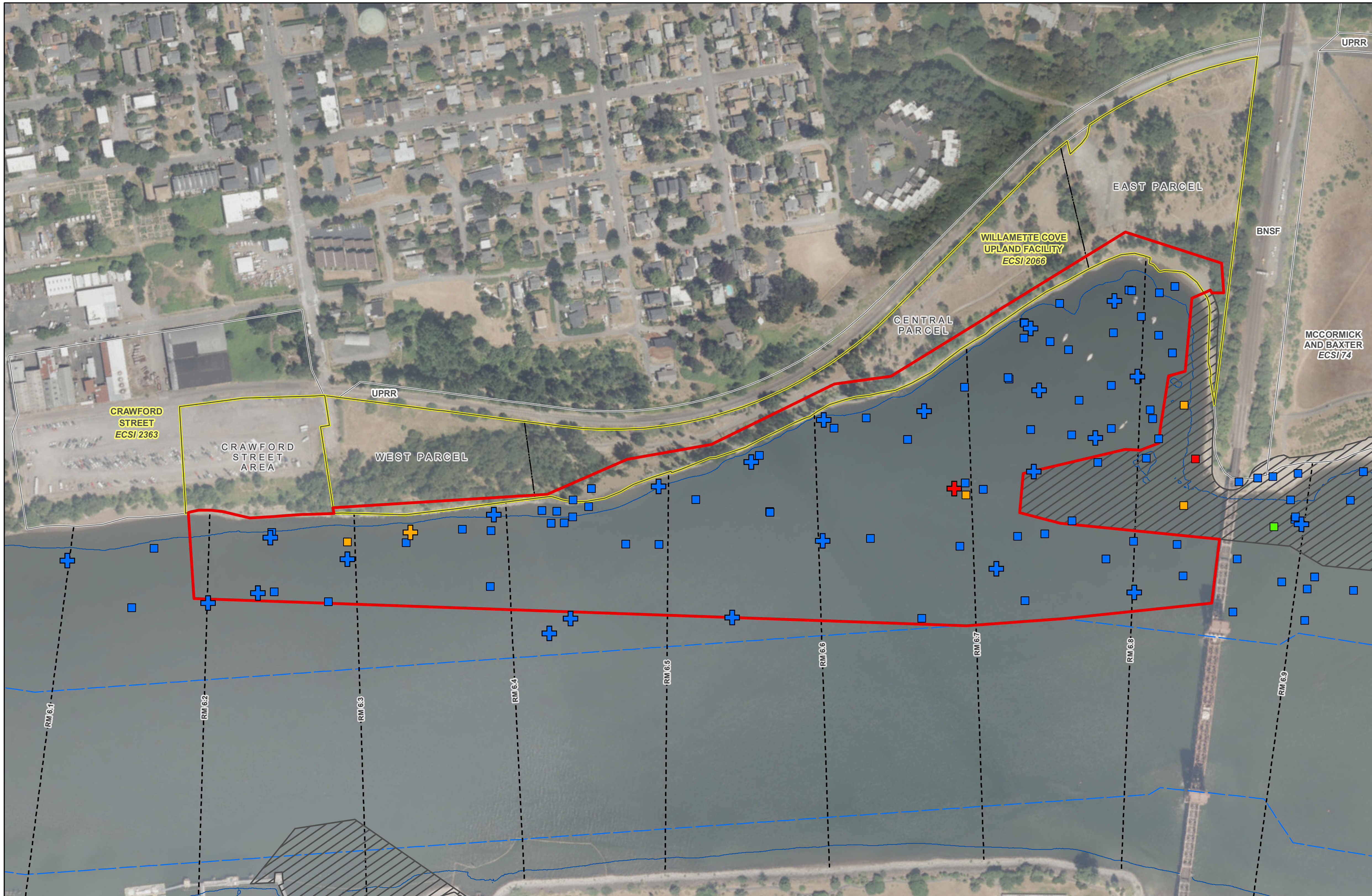


FIGURE 4-10

Total PAH Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

Total PAH Concentration (ug/kg)

- >106,000
- >30,000-106,000
- >23,000-30,000
- <23,000

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

Total PAH Criteria
Sediment Cleanup Level (CUL): 23,000 ug/kg
Sitewide Remedial Action Level (RAL): 30,000 ug/kg
Principal Threat Waste (PTW) Threshold: Not Applicable

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

N

0 175 350
Feet

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014,
Imagery COP Summer 2018

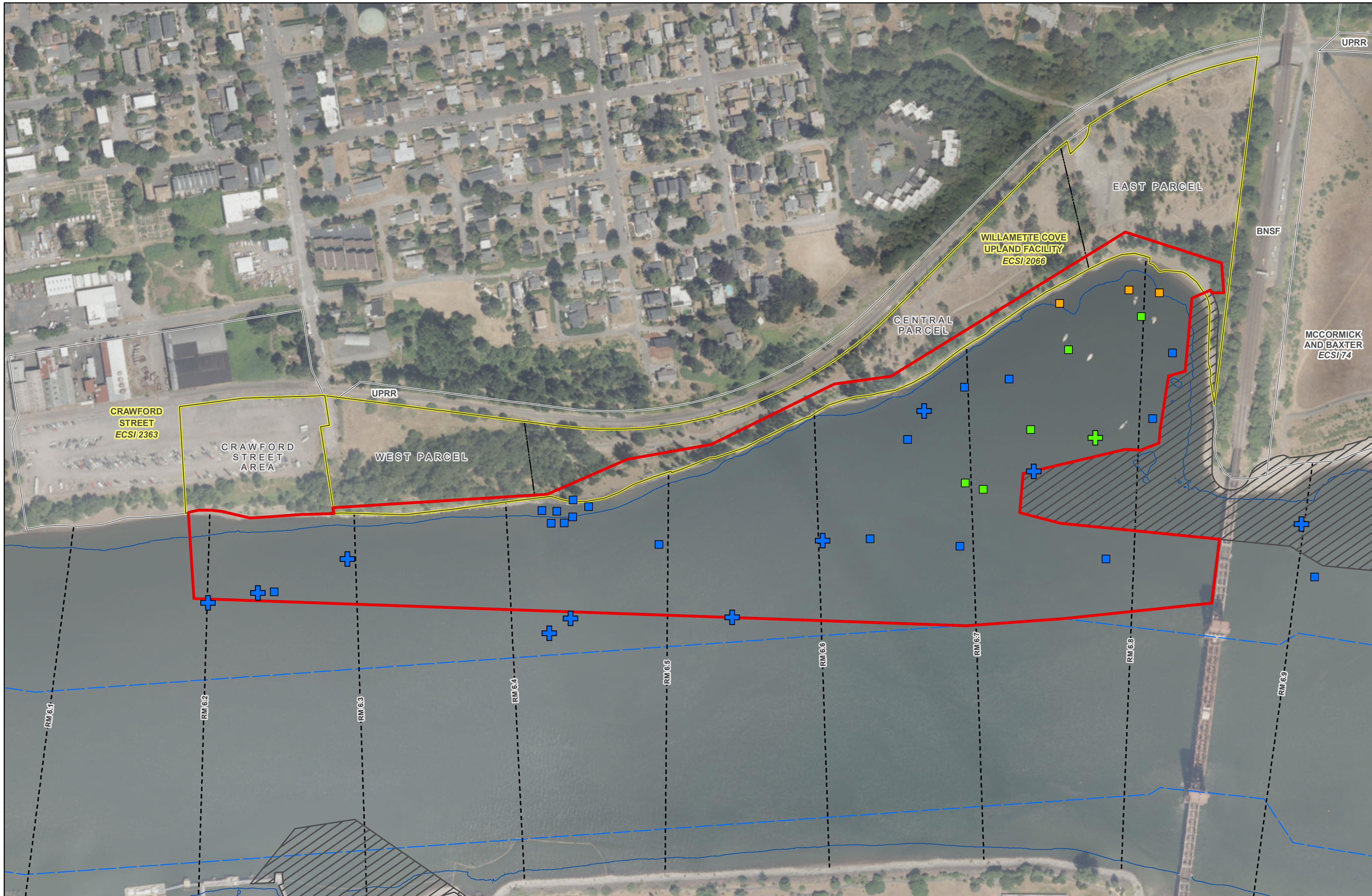
GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-10_Total_PAHs.mxd

FIGURE 4-11

TPH Diesel
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon



LEGEND

- Pre-RD Sample Location
- Historic Sample Location

TPH Diesel Concentration (mg/kg)

- >9,100
- >910-9,100
- >91-910
- <91

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

TPH Diesel Criteria
Sediment Cleanup Level (CUL): 91 mg/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: Not Applicable

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

N

0 175 350
Feet

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-11_TPH_Diesel.mxd

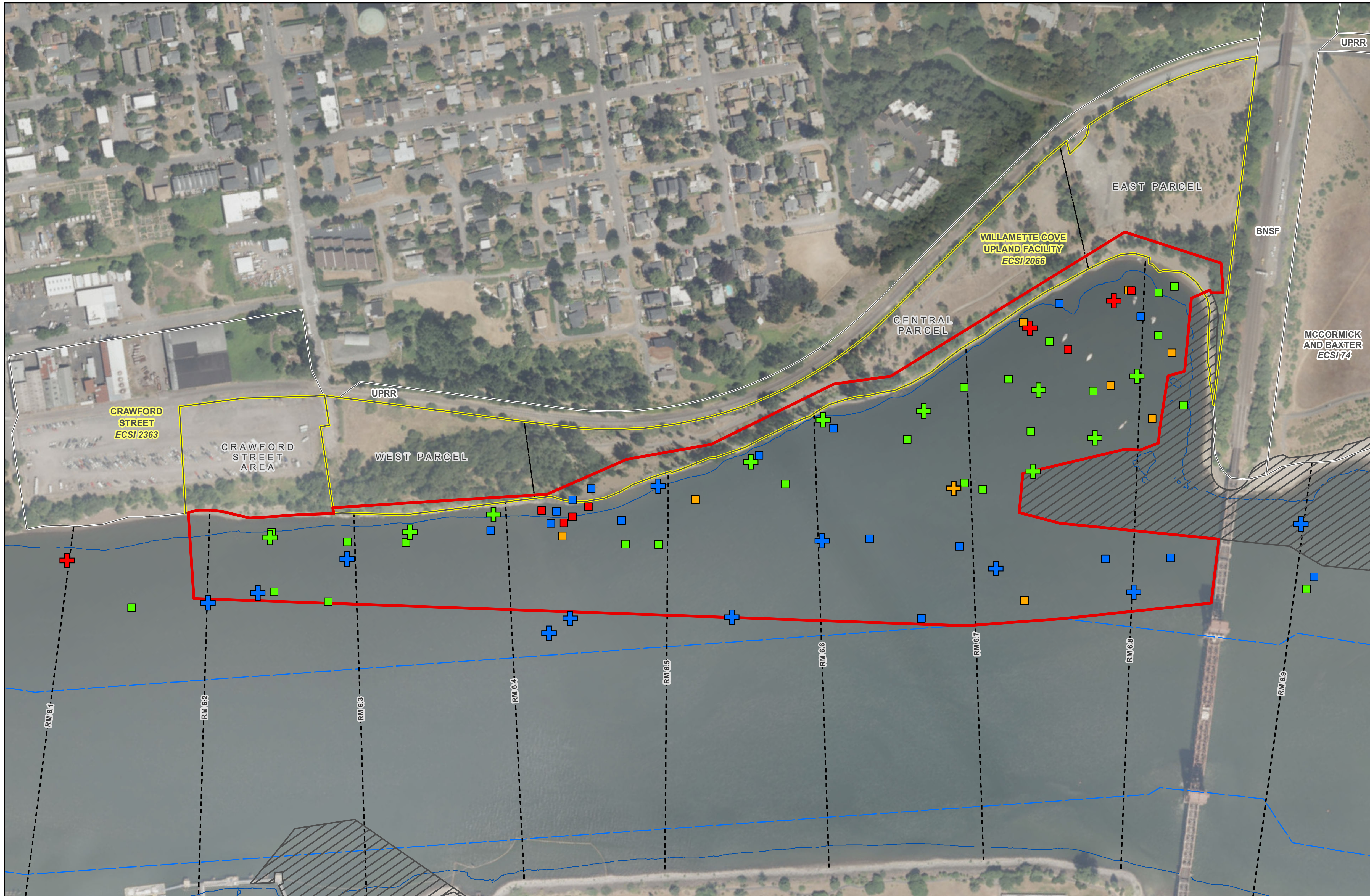


FIGURE 4-12

Total PCBs
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

Total PCB Concentration (ug/kg)

- >200
- >75-200
- >9-75
- <9

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Total PCB Criteria
Sediment Cleanup Level (CUL): 9 ug/kg
Sitewide Remedial Action Level (RAL): 75 ug/kg
Principal Threat Waste (PTW) Threshold: 200 ug/kg

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N

0 175 350
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-12_Total_PCBs.mxd

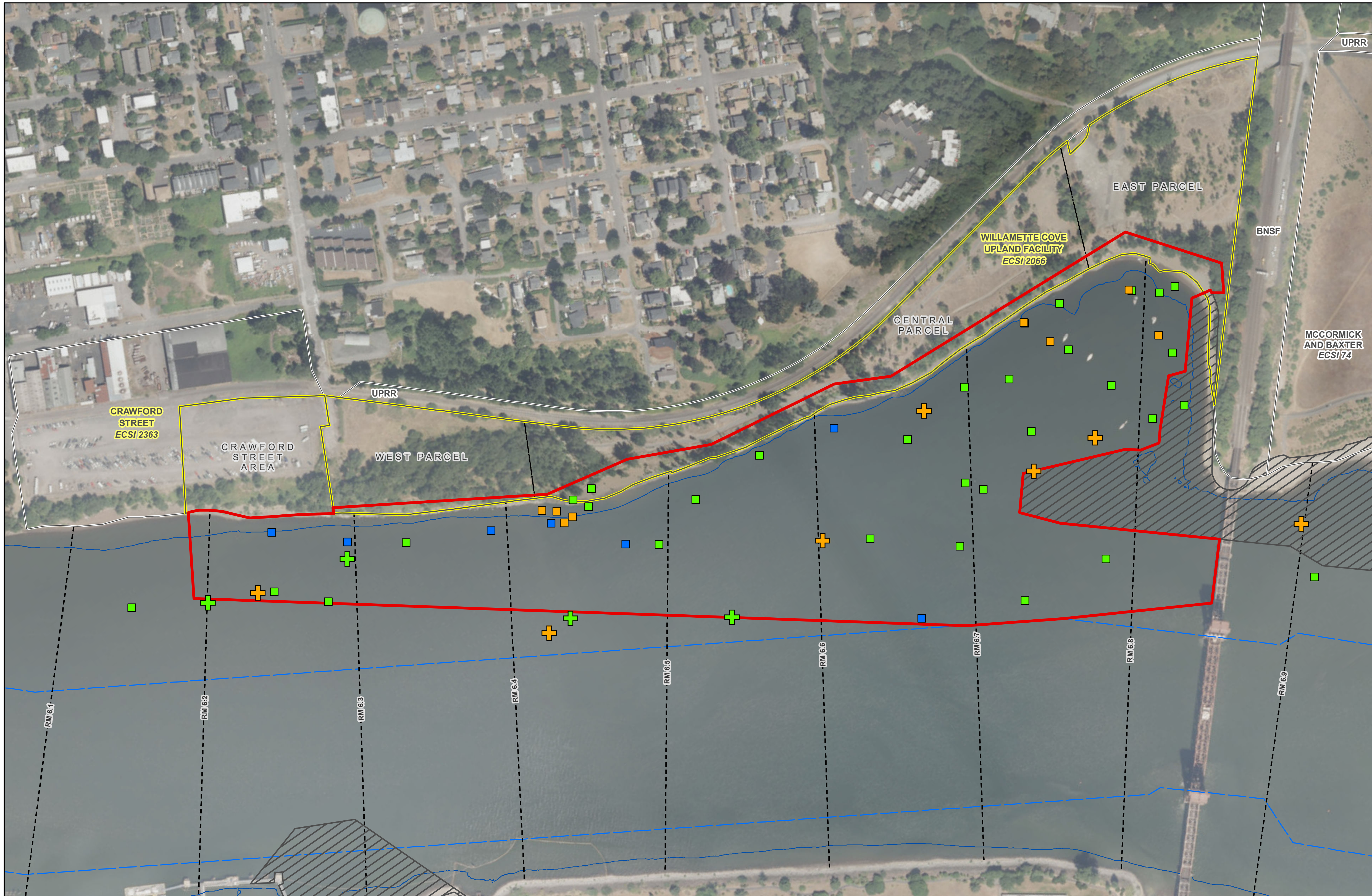


FIGURE 4-13

Dieldrin Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

Dieldrin Concentration (ug/kg)

- >7
- >0.7-7
- >0.07-0.7
- <0.07

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Dieldrin Criteria
Sediment Cleanup Level (CUL): 0.07 ug/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: Not Applicable

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N
0 175 350
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-13_Dieldrin.mxd

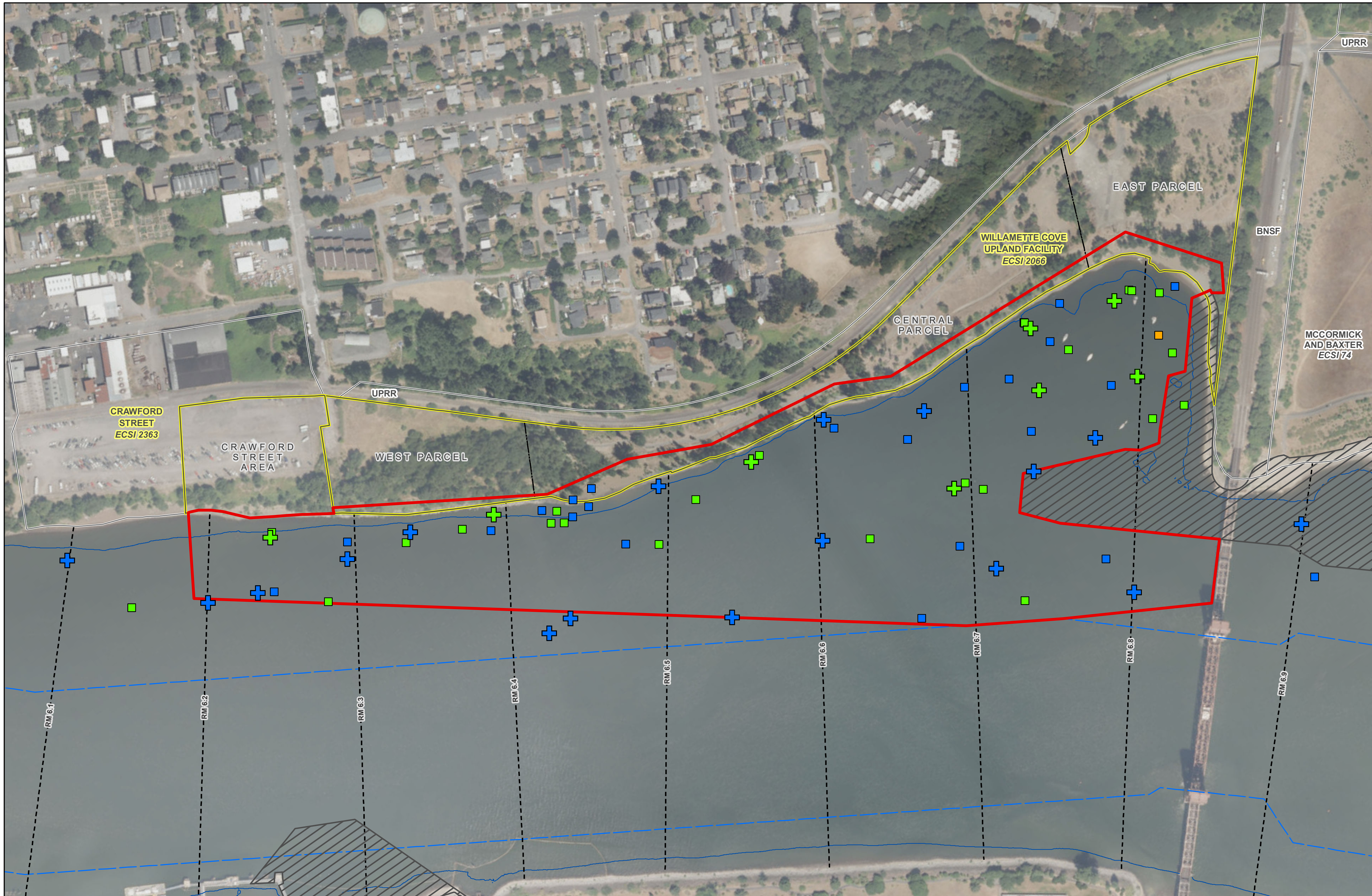


FIGURE 4-14

Total DDx
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

Total DDx Concentration (ug/kg)

- >7,050
- >160-7,050
- >6.1-160
- <6.1

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

Total DDx Criteria
Sediment Cleanup Level (CUL): 6.1 ug/kg
Sitewide Remedial Action Level (RAL): 160 ug/kg
Principal Threat Waste (PTW) Threshold: 7,050 ug/kg

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014,
Imagery COP Summer 2018

0 175 350
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-14_Total_DDx.mxd

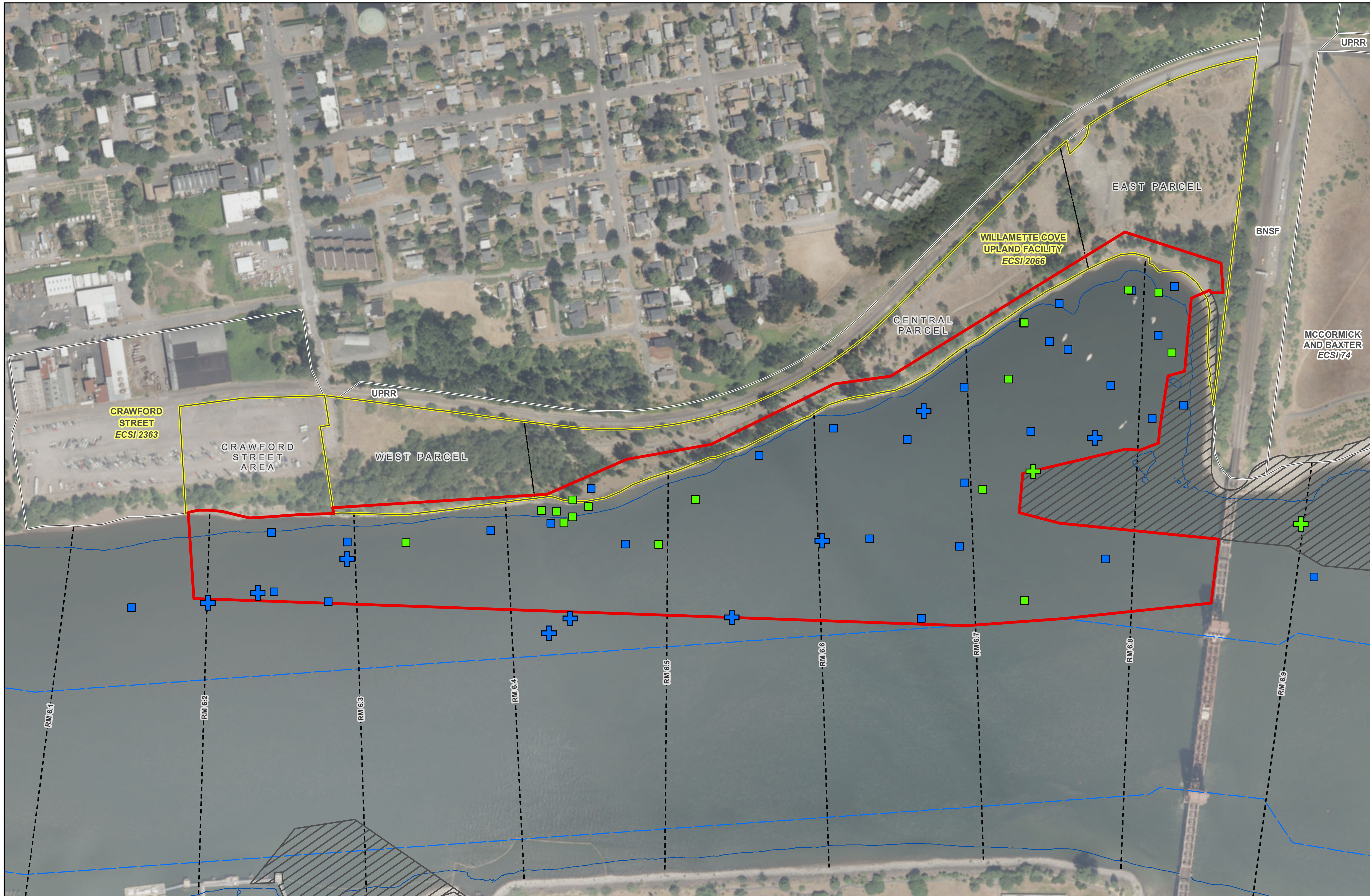


FIGURE 4-15

Total Chlordane Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Pre-RD Sample Location
- Historic Sample Location

Total Chlordane Concentration (ug/kg)

- >140
- >14-140
- >1.4-14
- <1.4

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

Total Chlordane Criteria
Sediment Cleanup Level (CUL): 1.4 ug/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: Not Applicable

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Date: May 27, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N

0 175 350
Feet

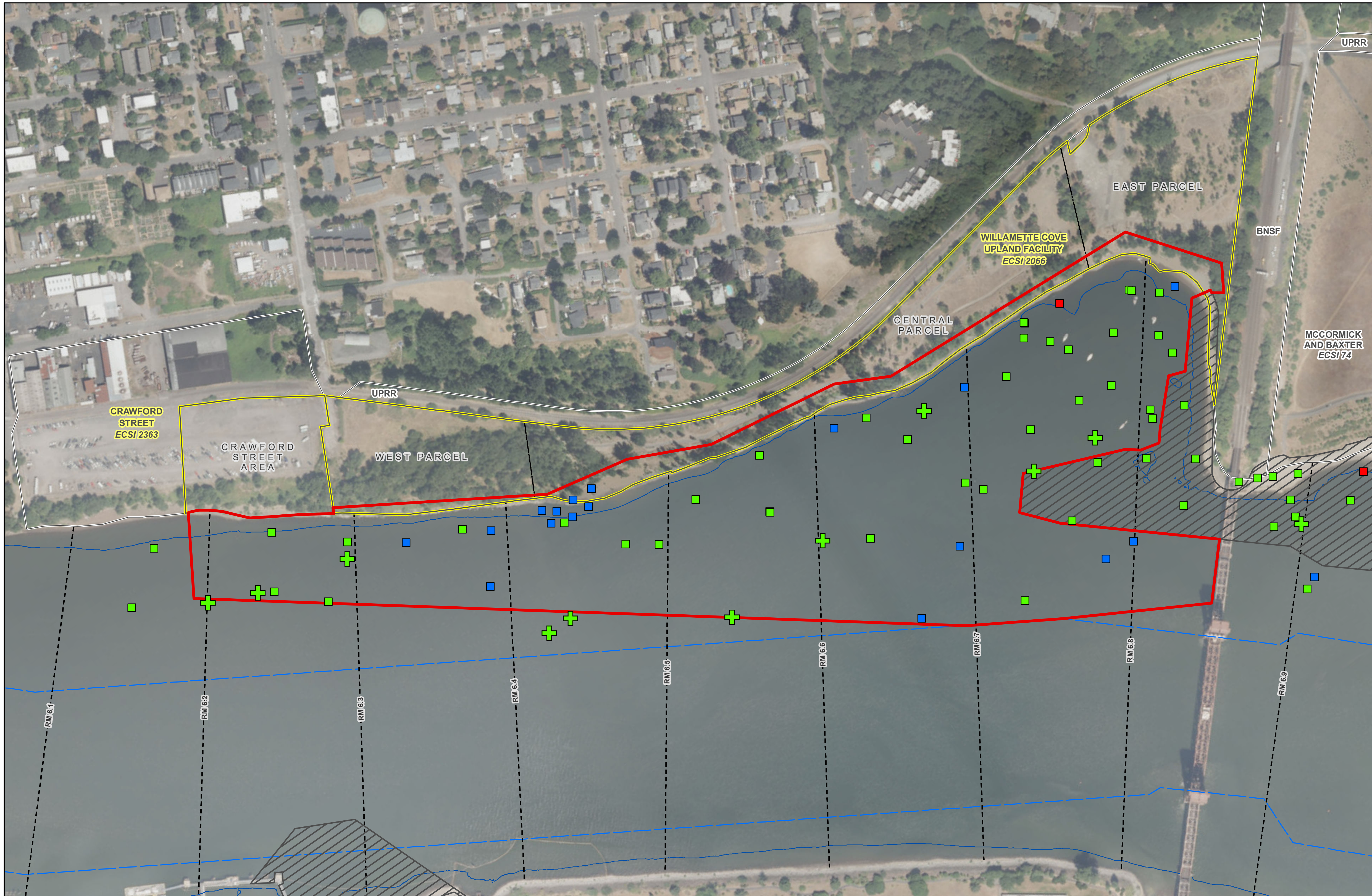
GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-15_Total_Chlordane.mxd

FIGURE 4-16

Arsenic
Surface Sediment Sample Results

Sufficiency Assessment
Willamette Cove
Portland, Oregon



LEGEND

- Pre-RD Sample Location
- Historic Sample Location

Arsenic Concentration (mg/kg)

- >8
- >3-8
- <3

All Other Features

- Willamette Cove Project Area Boundary
- Upland Parcel
- Upland Subparcel[1]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- -2 ft (CRD)
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Arsenic Criteria

Sediment Cleanup Level (CUL): 3 mg/kg
Sitewide Remedial Action Level (RAL): Not Applicable
Principal Threat Waste (PTW) Threshold: Not Applicable
DEQ Background Level (DEQ, 2013): 8 mg/kg

0 175 350
Feet

Date: June 24, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-16_Arsenic.mxd

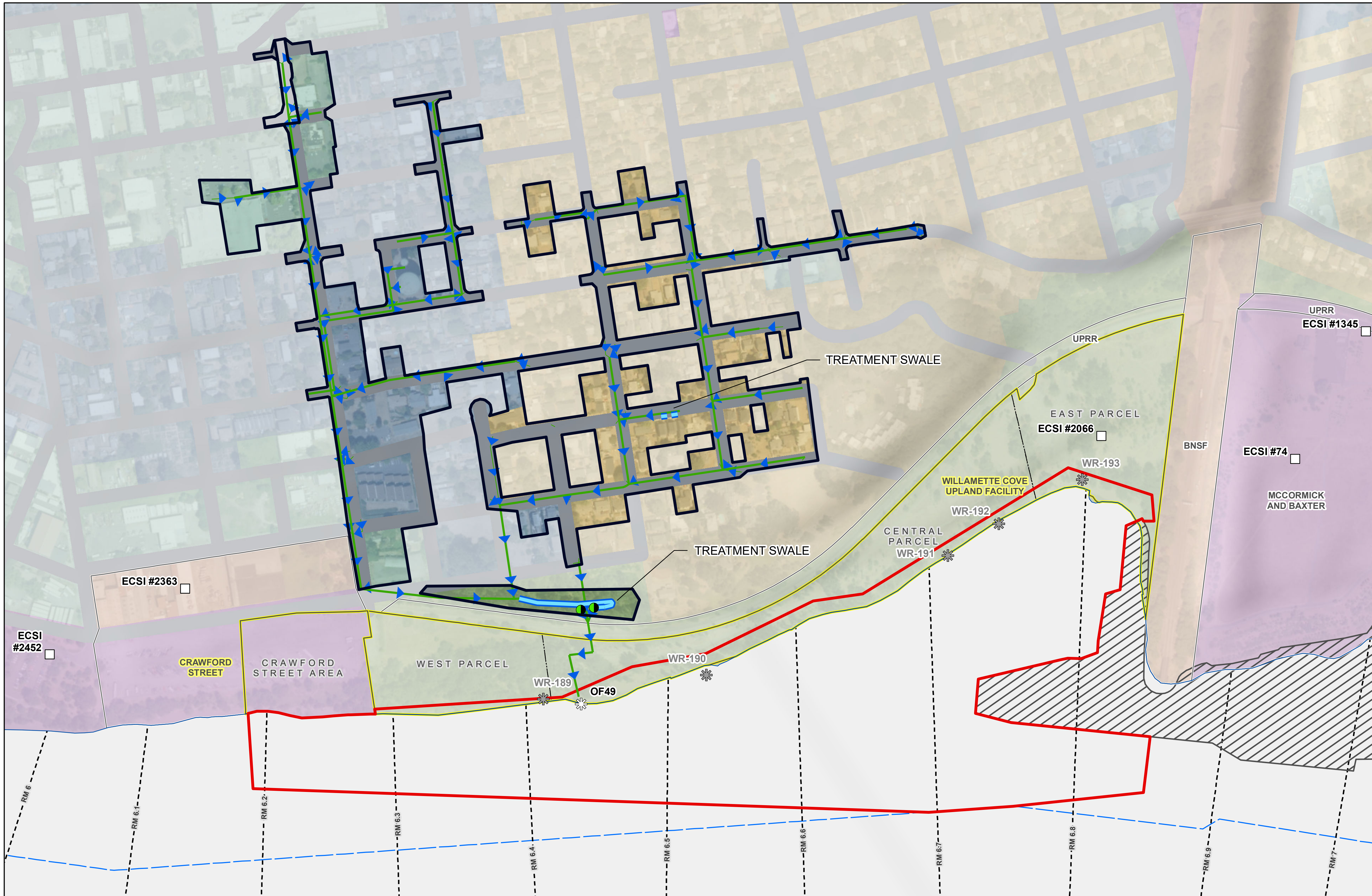


FIGURE 4-17

Outfall OF-49 Drainage Basin and ECSI Sites

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Outfall Basin
- City Outfall
- Historic Outfall[1]

Conveyance System

- Storm Gravity Main
- Treatment Swale
- Sediment Removal Structure

Zoning

- Commercial
- Industrial
- Multi-family Residential
- Mixed-use Employment
- Parks and Open Space
- Single Family Residential
- Roadway

All Other Features

- Willamette Cove Project Area
- Upland Parcel
- Adjacent Parcel
- Upland Subparcel[2]
- Capped Area
- USACE Navigation Channel
- River Boundary
- River Mile (RM)
- ECSI Site

NOTE

ECSI: Environmental Cleanup Site Information
OF: Outfall
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. Digitized from Revised Feasibility Study and Source Control Evaluation Willamette Cove Upland Facility. These outfalls were identified through field observations. They are not active and many are no longer present.
2. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Date: June 10, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N

0 200 400
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-17_Upland_Source_Areas.mxd

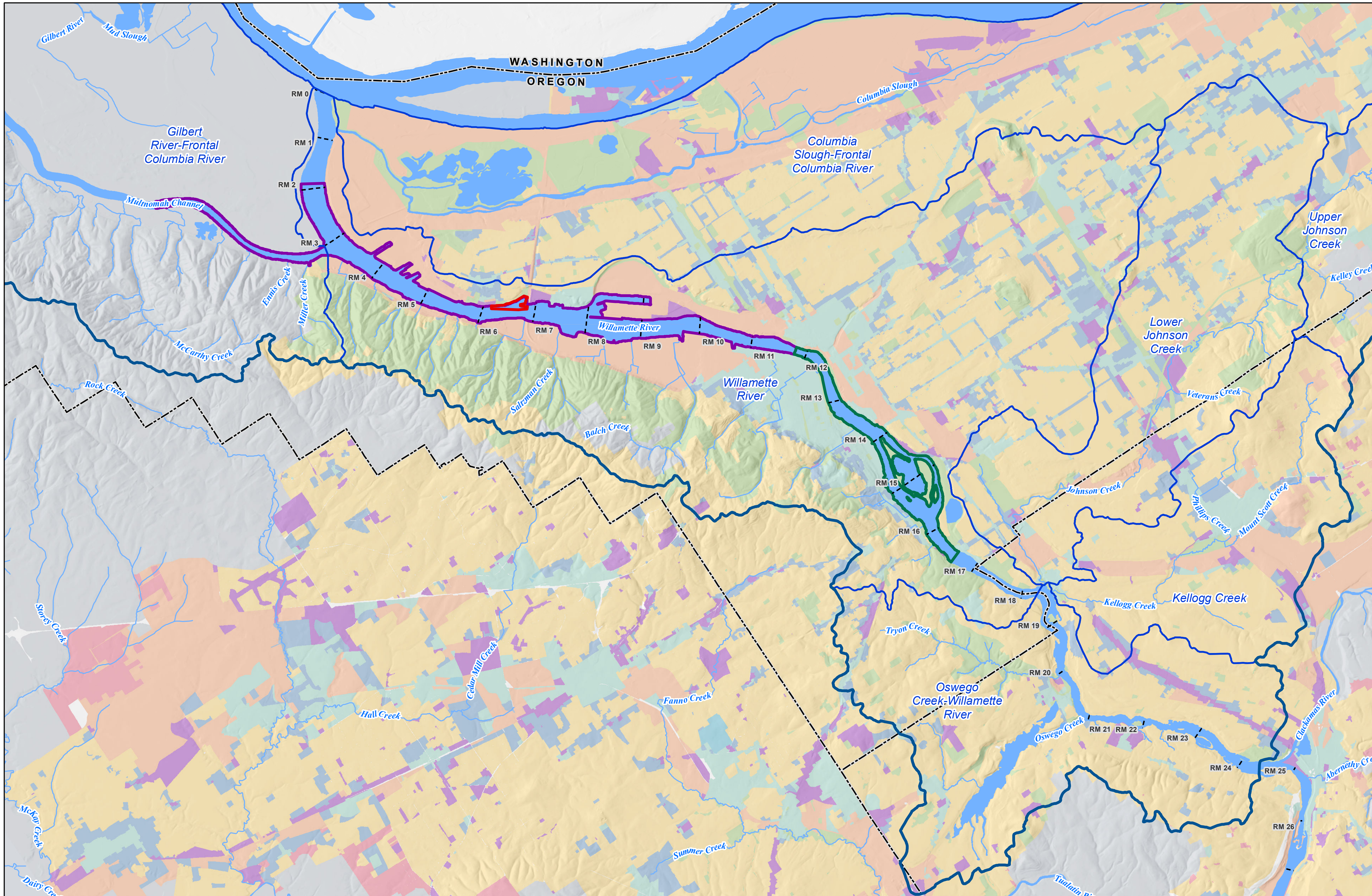


FIGURE 4-18

Lower Willamette Watershed and Land Use

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Willamette Cove Project Area Boundary
- Lower Willamette Watershed
- Subbasin Unit

Zoning

- Commercial
- Future Urban Development
- Industrial
- Multi-family Residential
- Mixed-use Employment
- Public Facilities
- Parks and Open Space
- Rural
- Single Family Residential

All Other Features

- River Mile (RM)
- Downtown Reach
- Portland Harbor
- County Boundary
- Watercourse
- Waterbody

Date: June 10, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-18_Watershed_LandUse.mxd

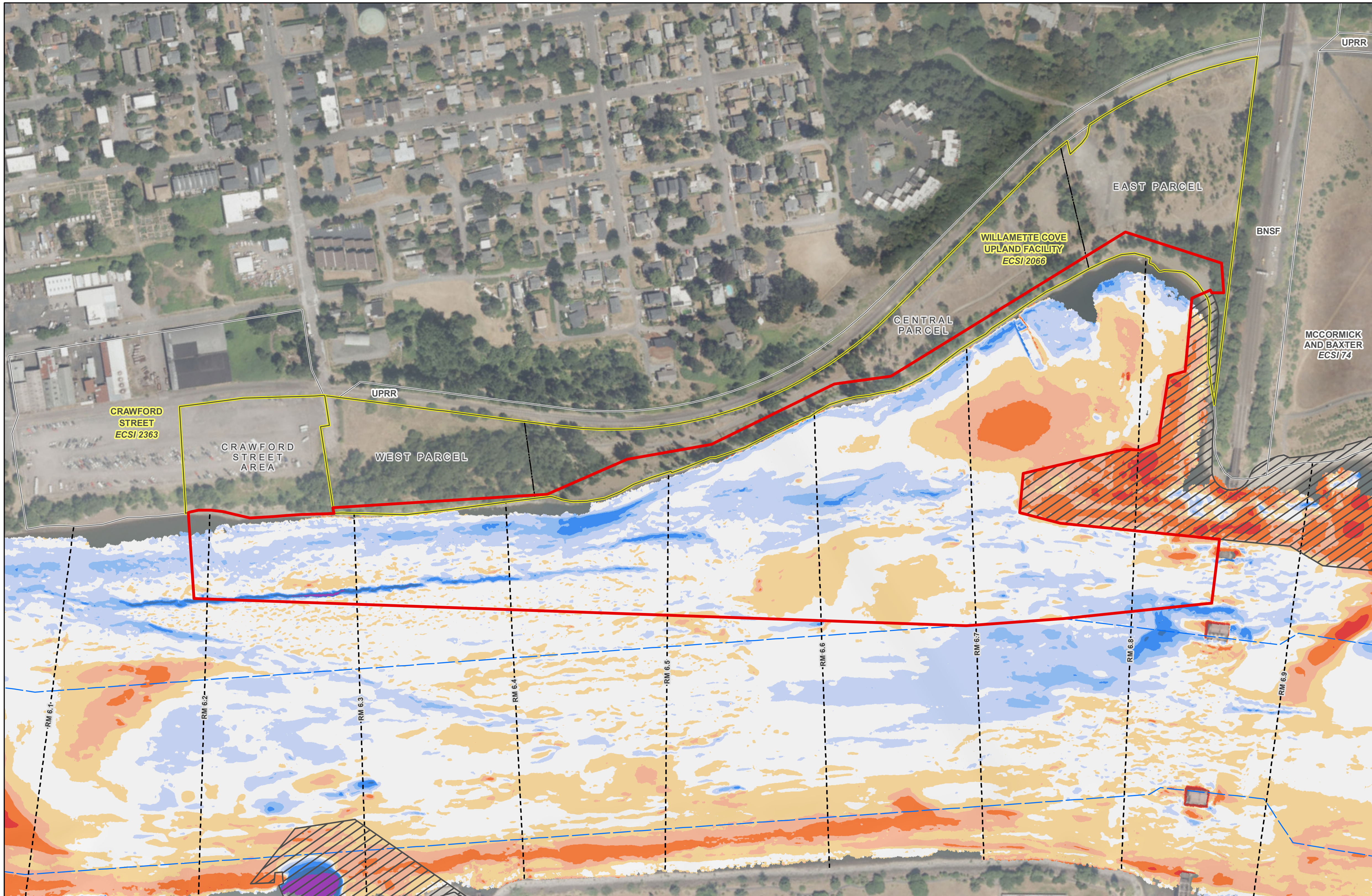


FIGURE 4-19

Bathymetric Change 2004 to 2018

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Willamette Cove Project Area Boundary

Bathymetric Change, Feet[1]

- > -10
- -10 to -5
- -5 to -2.5
- -2.5 to -1.5
- -1.5 to -0.5
- -0.5 to 0.5
- 0.5 to 1.5
- 1.5 to 2.5
- 2.5 to 5
- 5 to 10
- >10

All Other Features

- Upland Parcel
- Upland Subparcel[2]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- River Mile (RM)

NOTES

CRD:	Columbia River Datum
BNSF:	Burlington Northern Santa Fe Railroad
ECSI:	Environmental Cleanup Site Information
UPRR:	Union Pacific Railroad
USACE:	U.S. Army Corps of Engineers

1. Bathymetry from The Pre-Remedial Design Group Pre-Design Investigation (PDI) Evaluation Report (AECOM and Geosyntec 2018).
2. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].

Date: June 10, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure4-19_Bathymetric_Change.mxd

FIGURE 5-1

Upland Pathways Historical Data Points

Sufficiency Assessment
Willamette Cove
Portland, Oregon

LEGEND

- Monitoring Well[1]
- Groundwater Sample Location[2]
- Riverbank Sample Location[1,2]
- Riverbank Transect
- Treatment Swale
- City Outfall
- Historic Outfall[1]

All Other Features

- Willamette Cove Project Area
- Upland Parcel
- Upland Subparcel[3]
- Adjacent Parcel
- Capped Area
- USACE Navigation Channel
- Toe of Bank, -2 ft (CRD)[4]
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
OF: Outfall
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. Digitized from Revised Feasibility Study and Source Control Evaluation Willamette Cove Upland Facility, March 2019. These outfalls were identified through field observations. They are not active and many are no longer present.
2. Digitzed from Figure 3, Sample Location Diagram, Evren Northwest, and from Figure 2, Site Plan and Pushprobe Location, Rieke Consulting Services, LLC., August 2017.
3. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].
4. Toe-of-bank contour generated from 2020 site bathymetry, Solmar Hydro.

N

0 175 350
Feet

Date: June 24, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

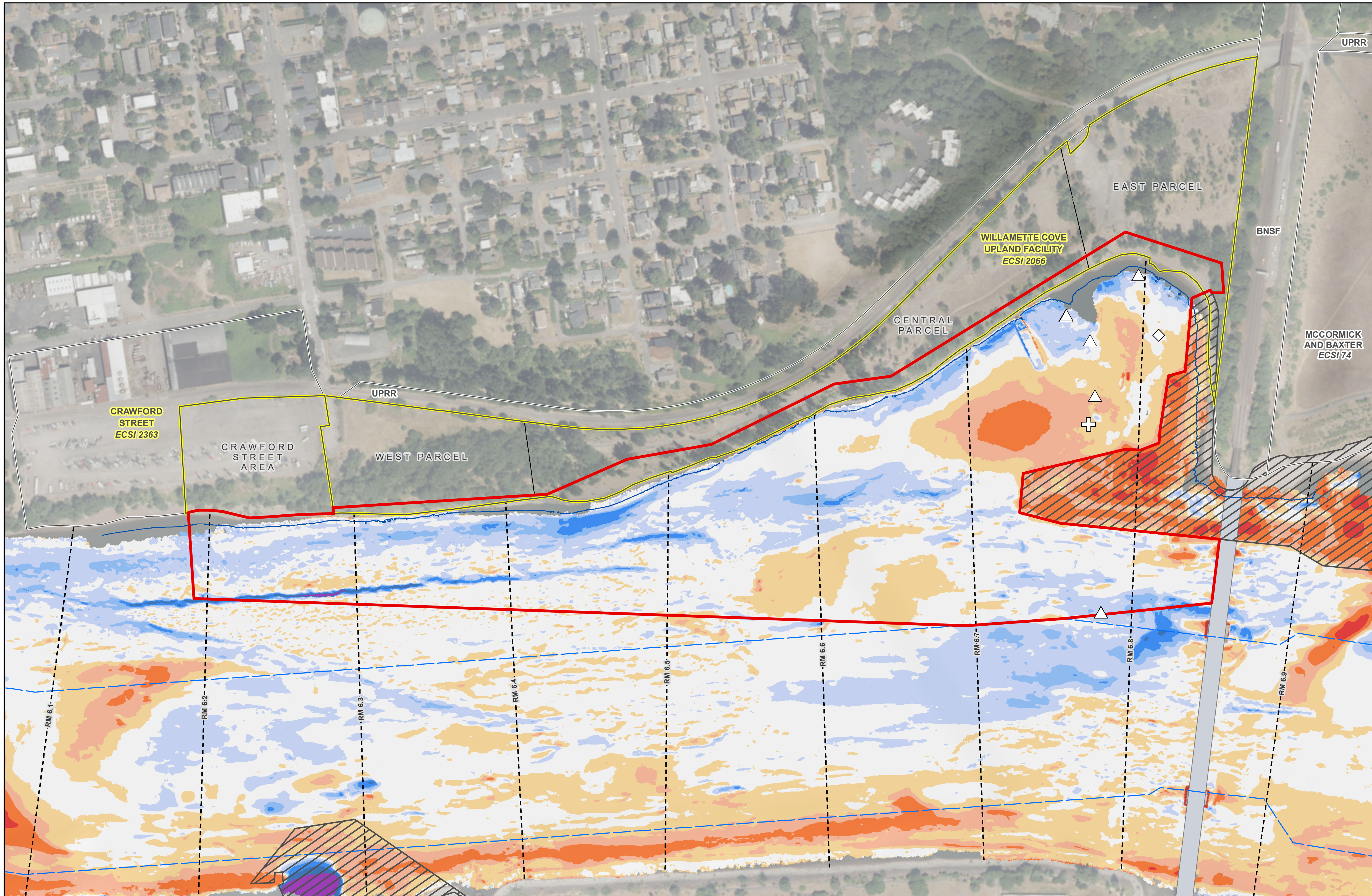
GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure5-1_Upland_Pathway_Data_Points.mxd

FIGURE 5-2

In-Water Pathways Historical Data Points

Sufficiency Assessment
Willamette Cove
Portland, Oregon



LEGEND

Sample Type

- Sediment Trap
- Porewater
- Surface Water

Bathymetric Change, Feet[1]

- > -10
- -10 to -5
- -5 to -2.5
- -2.5 to -1.5
- -1.5 to -0.5
- -0.5 to 0.5
- 0.5 to 1.5
- 1.5 to 2.5
- 2.5 to 5
- 5 to 10
- >10

All Other Features

- Willamette Cove Project Area
- Upland Parcel
- Upland Subparcel[2]
- Adjacent Parcel
- Capped
- Overwater Structure
- Toe of Bank, -2 ft (CRD)[3]
- USACE Navigation Channel
- River Mile (RM)

NOTES

BNSF: Burlington Northern Santa Fe Railroad
CRD: Columbia River Datum
ECSI: Environmental Cleanup Site Information
FT: Feet
UPRR: Union Pacific Railroad
USACE: U.S. Army Corps of Engineers

1. Bathymetry from The Pre-Remedial Design Group Pre-Design Investigation (PDI) Evaluation Report (AECOM and Geosyntec 2018)
2. The riverward boundary of the Crawford Street Area is at ordinary low water as defined by [USACE 2017].
3. Toe-of-bank contour generated from 2020 site bathymetry, Solmar Hydro.

Date: April 9, 2020
Data Sources: COP 2019, METRO 2020, USACE 2014, Imagery COP Summer 2018

N

0 175 350
Feet

GSI Water Solutions, Inc.

Document Path: Y:\0115_POP_WillametteCove\Source_Figures\SufficiencyAssessment\Figure5-2_InWater_Pathway_Locs.mxd

EPA Comments and Responses on Draft (dated April 10, 2020) and Final (dated June 29, 2020) Sufficiency Assessment and Pre-Design Investigation Work Plan
Willamette Cove Project Area
Portland Harbor Superfund Site
July 21, 2020

This is EPA's conditional approval of the Final Sufficiency Assessment Report (SA Report) and Final Pre-Design Investigation Work Plan (PDIWP) dated June 29, 2020. Approval is conditioned on the Willamette Cove Group (WC Group) adequately addressing EPA's responses as outlined below. Approval excludes PDIWP Appendix C – GSI Site-Specific Health and Safety Plan which EPA does not approve but reviews for completeness.

EPA's response to the WC Group Final SA Report and PDIWP (dated June 29, 2020) and WC Group responses to EPA's comments on the Draft documents (dated April 10, 2020) are provided. Responses follow discussions between EPA and the WC Group at the July 8, 2020 conference call.

EPA Comments on the Sufficiency Assessment Report

Unless mentioned otherwise, the responses to EPA's comments on the Draft SA Report are acceptable; however, the information presented in the responses for the following comments should be included as a revision to the text or as an attachment to the final approved SA Report.

EPA General Comment 1 (5/15/2020)

Recontamination is assessed after remediation to determine if the Portland Harbor Superfund Site (PHSS) Record of Decision (ROD) Table 17 cleanup levels (CULs), as modified by the 2019 Explanation of Significant Differences (ESD) and the 2020 Errata #2 memorandum, are exceeded in the appropriate media over an appropriate time and spatial scale. EPA will evaluate recontamination as part of the five-year review process under the Comprehensive Environmental Response, Compensation, and Liability Act. WC Group will need to consider all Table 17 contaminants of concern (COCs) as part of their remedial design (e.g., capping effectiveness or dredging leave surface) and future monitoring.

WC Group Response (6/29/2020)

The WC Group concurs that recontamination will be evaluated following the remedy implementation during the 5-year reviews. As part of the remedial design (RD), the WC Group will evaluate sediments for all the Table 17 constituents on the presumed dredging leave surfaces consistent with the February 2020 Remedial Design Guidelines and Considerations (RDGC).

EPA Response

EPA understands, based on the discussion with the WC Group on the July 8, 2020 conference call, that the response will be updated to state that sediment and groundwater for all Table 17 COCs will be evaluated as part of RD.

EPA General Comment 2 (5/15/2020)

The SA Report should explain how the data gaps in groundwater source control will affect the remedial design process. While the groundwater pathway is identified as "C- not sufficiently assessed or controlled," it is not clear when in the remedial design process a decision will be made to design the sediment/riverbank cap to mitigate the groundwater plume or to design and implement a shore-based groundwater source control measure. There should be an assessment of how the uncontrolled groundwater plume will adversely affect the in-water dredging and capping offshore within the Project Area. As stated in the Administrative Settlement Agreement and Order on Consent for Remedial Design at Willamette Cove Project Area (ASAOC), the SA report is to include an assessment of the degree to which the proposed remedy will address upland and in-water sources of COCs to the Project Area.

WC Group Response (6/29/2020)

The WC Group recognizes and agrees with the importance of understanding groundwater (and other upland sources) in the remedial design process. Section 5.1.2 of the SA Report provides an evaluation of the groundwater pathway. To address this comment, additional text has been added to Section 5.1.2 to clarify how groundwater will be assessed. The new text describes how groundwater may impact remedial design, and the approach to assessing groundwater, which begins by sampling porewater in targeted areas during the Phase I PDI. If porewater CULs are exceeded, additional data would be collected in a Phase II PDI to determine whether porewater impacts are from sediments or from contaminated groundwater discharging to the in-water Project Area. The porewater data will also be used to determine the potential for adverse impacts to the remedy and will feed into the design process to support cap design.

EPA Response

During the July 8, 2020 conference call, the WC Group clarified that they do not have enough information to determine whether groundwater contamination will be addressed through the in-water remedy or upland source control or both. A phased approach is planned and further decision making will occur after the initial PDI porewater data to help identify what is needed for the supplemental PDI. Both upland and in-water work will be informed and decisions made from this PDI data and groundwater data collected from the uplands. EPA finds this phased approach acceptable.

EPA General Comment 5 (5/15/2020)

The Oregon Department of Environmental Quality (DEQ) background values should not be used to screen out metals as COCs. EPA established the background sediment concentration of 3 mg/kg for arsenic in the remedial investigation/feasibility study and used that value to establish the sediment arsenic CUL in the ROD. Arsenic is a COC in soil and groundwater in the Willamette Cove Upland Facility and should be retained as a site-specific COC for the in-water remedial design (RD). Evaluation of arsenic as a COC is needed in the SA Report to assess the effects of upland sources on achieving the RAOs.

WC Group Response (6/29/2020)

We acknowledge exceedances of the 3 milligram per kilogram (mg/kg) background concentrations established by EPA in upland soil and surface sediments. We also acknowledge that arsenic is above background in groundwater on the West Parcel of Willamette Cove and above CULs in riverbank soil. However, there are no known upland sources of arsenic in soil in the uplands adjacent to the Project Area, and arsenic is naturally elevated in soil in the Portland Basin and throughout Portland Harbor. The sediment data screening that was completed in the SA Report showed that, of the 60 sediment samples in the Project Area, 43 exceeded the EPA background level yet only one sample exceeds the DEQ background level of 8 mg/kg. This narrow and uniform distribution does not suggest an upland source and further supports that concentrations are a result of background level occurrences of arsenic.

To address this comment, arsenic has been retained as a sediment COC in this SA Report, but the uncertainty related to arsenic background will be considered throughout RD. The text and tables (primarily in Section 3) have been modified accordingly.

EPA Response

Comment addressed by retaining arsenic as a COC. As EPA noted during the July 8, 2020 conference call, upland source control documents do list undocumented fill at the former log pond in the Willamette Cove uplands and McCormick & Baxter wood treating contamination as a potential source of arsenic. EPA understands that WC Group will look into this information for consideration in subsequent versions of the SA report.

EPA General Comment 8 (5/15/2020)

The SA Report should evaluate potential impacts of pentachlorophenol in sediment on achieving the RAOs of the PHSS selected remedy. Pentachlorophenol exceeds groundwater CULs in the Willamette Cove Upland Facility and was released in large quantities from McCormick & Baxter process water. This report does not provide any data on pentachlorophenol in sediments. Discuss whether pentachlorophenol was ever sampled in the Willamette Cove Project Area sediments. If not, this should be considered a data gap and should be assessed further. If data is available, it should be compared to screening levels from the McCormick & Baxter site and other sites. Although the PHSS ROD does not have a sediment CUL for pentachlorophenol, it has potential to present at high concentrations in the Willamette Cove Project Area due to the McCormick & Baxter site releases and potentially due to releases from the former plywood mill on the eastern portion of the Willamette Cove Upland Facility.

WC Group Response (6/29/2020)

There are no sediment data for pentachlorophenol (PCP) because this chemical is not included as a COC for sediments in Table 17 or Table 21. Additional text has been added in Section 3.1.2 to document the absence of PCP data in sediments.

EPA Response

At the July 8, 2020 conference call, the WC Group stated that their inclusion of PCP in the analyte list for porewater sampling is sufficient to assess PCP contamination in the WC project area. They will not add PCP to the analyte list for sediment because there is no ROD CUL for PCP in sediment and that the porewater sampling will identify any PCP impacts in the areas of sample collection. EPA finds this approach acceptable.

EPA General Comment 9 (5/15/2020)

A section listing the sources of data used in the COC screening and evaluation of contaminant transport pathways should be added to the SA Report. EPA recommends including the data used in the evaluation as an attachment to the SA Report.

WC Group Response (6/29/2020)

The references documenting the sources of data are included in Section 3.1 and in the reference section of the SA Report. These data are publicly available.

EPA Response

At the July 8, 2020 conference call, EPA explained that an additional narrative was needed in the SA report explaining the data sources and general time period of the data that was presented and used in the SA report evaluations. EPA understands that the WC Group will provide this in subsequent updates to the SA Report.

EPA General Comment 10 (5/15/2020)

The occurrence of nonaqueous phase liquid (NAPL) and petroleum hydrocarbon sheen at the Willamette Cove riverbank and sediment area should be included in the conceptual site model (CSM) presentation. NAPL and petroleum hydrocarbon sheens have been detected within the Project Area and the occurrence of NAPL will affect RD.

WC Group Response (6/29/2020)

Discussion of the presence and absence of non-aqueous phase liquid (NAPL) and petroleum hydrocarbon sheen at the Willamette Cove riverbank and sediment area has been added to Section 4.3.2.1 of the CSM.

EPA Response

At the July 8, 2020 meeting, EPA explained that the January 2020 Groundwater Source Control Alternative Evaluation report for Willamette Cove had maps showing sheen or NAPL at other areas across the West, Central, and East Parcels and that this information is not in the SA report or their response to General Comment 10. The WC Group said they will look into this and EPA assumes an updated CSM will be included in a subsequent SA Report.